

FRED Reports

FRED 1989 ANNUAL REPORT TO THE ALASKA STATE LEGISLATURE

Edited by
J. S. Holland, Ph.D.

Number 101



Alaska Department of Fish & Game
Division of Fisheries Rehabilitation,
Enhancement and Development

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Alaska Department of Fish and Game
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Enhancement and Development

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ABSTRACT (100 words maximum) FRED's major objectives are the rehabilitation, enhancement, development, protection, and maintenance of the salmon, trout, sheefish, and grayling resources of the state for the use of all Alaskans. To accomplish these, FRED utilizes hatcheries, stream rehabilitation, lake stocking, and fishways as its basic tools. Hatcheries are about eight times more efficient in converting eggs to fish than the natural environment, and fishways open new spawning areas to anadromous fishes. FRED's Limnology, Coded-Wire Tag Processing, and Pathology Laboratories continue to provide important information about the state's fishery resources. FRED encourages rehabilitation efforts by private nonprofit aquaculture corporations and provides technical services to them. Over 1.4 billion salmon eggs were collected for hatcheries in the State of Alaska during 1989 through the combined efforts of FRED Division and private nonprofit hatchery operators. During 1989 FRED released more than 228 million juvenile fish. Approximately 324 million eggs were taken for incubation during the year, and over 12 million salmon and trout returned in 1989 as a result of FRED projects. Private nonprofit hatcheries throughout the state released over 860 million salmon and collected over 1.1 billion salmon eggs in 1989. An estimated 24 million adult salmon returned in 1989 as a result of private nonprofit hatchery operations.		SUBJECT CATEGORY <input checked="" type="checkbox"/> NATURAL RESOURCES <input type="checkbox"/> EDUCATION <input type="checkbox"/> SOCIAL SERVICES <input type="checkbox"/> HEALTH <input type="checkbox"/> TRANSPORTATION <input type="checkbox"/> LAW ENFORCEMENT <input type="checkbox"/> COMMERCE & INDUSTRY <input type="checkbox"/> GENERAL GOVERNMENT <input type="checkbox"/> LOCAL GOVERNMENT <input type="checkbox"/> OTHER
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PREFACE

This annual report is an attempt to provide under one cover a comprehensive documentation of the Alaskan enhancement program. Alaskan fisheries enhancement is a very diverse and multidimensional program consisting of comprehensive regional planning, lake and stream rehabilitation, fish ladders, spawning channels, hatchery production, pathology, genetics, limnology, and coded-wire tagging laboratories and research and development. The Alaskan enhancement program was created in an effort to rehabilitate the state's depleted and depressed salmon fishery in the early 1970s and to address the problem of unstable supply historically. Enhancement is designed to contribute to the common property fishery (commercial, sport, subsistence, and personal use) for the benefit of all Alaskans.

On the Pacific Coast of North America the use of hatcheries as an enhancement tool to produce juvenile salmon which feed and mature in the North Pacific Ocean is a traditional method of salmon enhancement. The first hatchery was developed on the McCloud River, California in 1872. While the use of hatcheries have been a traditional method along the Pacific Coast, the program which evolved in Alaska has many unique features. The common feature to other Pacific Coast states, as well as the rest of the United States, is a major public enhancement program including hatcheries. The unique aspect of the Alaskan program relates to development of private nonprofit (PNP) program which also produces juvenile salmon from hatchery programs. Aside from the many fish ladders in the State of Alaska and numerous stream and lake rehabilitation projects the State of Alaska has 35 hatcheries; 16 public, 16 PNP, 3 publicly owned which are contracted to PNP corporations. Capital construction funding to date for public and PNP hatcheries total roughly \$140 million in the form of public bonds, PNP loans or federal mitigation grants.

The Alaskan enhancement program has been characterized by phenomenal biological success. It has grown from the first return of pink salmon in 1976 of 30,000 fish statewide to a total return in 1989 of over 36 million. Similarly the eggtake in 1974 was 22 million while the eggtake in 1989 was 1.4 billion statewide. This unprecedented growth that has occurred in just 13 years makes the Alaskan hatchery enhancement effort the largest of its kind in North America and second largest in the world, behind Japan. Alaska is the world leader in the production of sockeye salmon taking over 100 million eggs under hatchery culture for the last five years. As this research and development program has evolved it allowed us to achieve a major breakthrough in sockeye culture which resulted in the hatchery production of 3.9 million sockeye smolts at the Main Bay Hatchery.

Significant milestones have also been reached in the non anadromous trout program involving production of unique Arctic species such as Arctic char, grayling, lake trout, and sheefish not to mention the more traditional rainbow trout. Over 10 million eggs were taken in 1989 and stocked into numerous lake systems in the interior for enhancement of the sport fishery.

In addition to the biological achievements the enhancement effort has the potential to have a profound impact on the regional economy of the state. Application of an economic impact model developed by the Institute of Social and Economic Research (University of Alaska Anchorage) has been applied to the enhancement program on an annual basis. This model projects that roughly \$80 million in resident income and

approximately 2300 resident jobs result from the state and PNP enhancement program. In this regard the enhancement program can help Alaskans cope with the adversity of declining state revenues by diversifying the economy and meeting the challenge of the 1990's.

FRED DIVISION BACKGROUND

The Fisheries Rehabilitation, Enhancement and Development (FRED) Division of the Alaska Department of Fish and Game (ADF&G) plays a major role in the state's salmon management program. Its purpose is to sustain and enhance Alaskan fisheries through the development and application of technologies in supplemental production and natural stock rehabilitation. The division's roles are: development of new enhancement technology; hatchery production for sport, subsistence, and non-cost-recovery commercial fisheries; technical services; habitat restoration and fisheries rehabilitation; regulation and management of the Private Nonprofit (PNP) Program; and statewide program coordination, including production, planning, and technology transfer. As such, it **contributes knowledge** gained from tagged-fish studies and technological research; it **mitigates fish losses** from foreign interceptions and environmental disruptions; it **contributes fish** to existing but depressed fisheries; it **creates new opportunities** for commercial, sport, and subsistence fisheries; and it **aids other aspects** of the statewide enhancement program through technical services and PNP Program coordination.

Statutory Authorities

The mission of FRED is to plan and implement a program that ensures the perpetual and increasing production and use of Alaska's fishery resources (AS 16.05.092). In addition, members of FRED Division, with approval of the Commissioner's Office, coordinate the rehabilitation and enhancement activities of the department and regional aquaculture associations (AS 16.10.380) and process fish transport permits and applications for PNP hatcheries (AS 16.10.440). The division also technically assists the PNP hatcheries to the extent possible (AS 16.10.443) and cooperates in the development of regional salmon plans (AS 16.10.375).

FRED Division's duties (AS 16.05.092) include the annual presentation of a comprehensive report to the Legislature. This report, along with a detailed budget request, satisfies the division's reporting requirements.

Functions and Services

The FRED Division operates 16 hatcheries to produce salmonid fishes for subsistence, commercial, and sport fisheries. Fishpasses located throughout the state provide spawning and rearing habitat that would otherwise be unattainable to salmon stocks. Many of these fishpasses are maintained cooperatively with the U.S. Forest Service (USFS). The strategies of lake fertilization, habitat improvement, and fish stock introduction are used to provide improved freshwater survival and new production opportunities for salmon stocks.

FRED Division operates four laboratories that serve ADF&G and other agencies. The Fish Pathology Section has two labs, one in Anchorage and one in Juneau, to provide diagnostic services and broodstock evaluation for both state and PNP fisheries programs. The Limnology Section provides supervision of all lake enrichment projects and analyses of water, plankton, and aquatic insect populations sampled for lake productivity studies.

The Coded-Wire Tag Processing Laboratory decodes metal tags implanted in fish and supplies resultant information for hatchery and natural stock evaluation, as well as for the evaluation of U.S./Canada salmon interceptions.

The PNP Program is administered by the division. One of the responsibilities of administering this program is to organize the regional salmon planning teams, which are comprised of ADF&G and regional aquaculture association members. The PNP office coordinates the review of PNP hatchery applications and the permitting process, which includes hatchery and fish transport permits.

FRED Division is involved in the organization, permitting, and coordination of shellfish mariculture projects. The program continued in 1989 with aid to active and potential private mariculturists working on scallop, mussel, and oyster projects.

FRED PRODUCTION SUMMARY

Total production for the FRED Division increased to slightly over 12 million fish in 1989 (Figure 1). This is a tremendous increase of approximately 6.9 million fish above the 1988 production figure. The primary cause for this increase is the ten-fold increase in pink salmon production at Kitoi Bay Hatchery. This return is indicative of a marine survival of approximately 8% for the 1987-brood pink salmon released in 1988. Whether or not the lack of commercial fishing in the oil-impacted area influenced this number is not known. Production figures for all areas of the state other than the Kodiak area remain fairly consistent with prior-year numbers. By species, chinook and coho salmon production decreased slightly in 1989 while chum salmon decreased significantly. Sockeye salmon production increased significantly, while production of nonanadromous species remained fairly consistent, except for rainbow trout which dropped significantly.

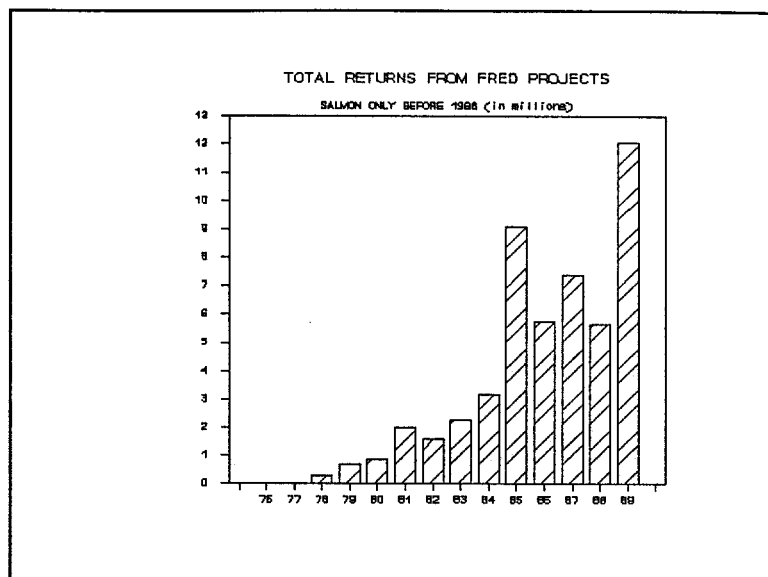


Figure 1

Releases of fish from FRED facilities decreased to 228.8 million fish in 1989 (Figure 2) from a total of 412.6 million fish in 1988. The observed decrease in FRED releases in 1989 primarily is a factor of transferring the operations of hatcheries in 1988. As releases were made before the transfer of operations in 1988, release information was reported for those affected facilities in the state portion of the 1988 annual report. Thus, the effect of the transfer on release data is seen for the first time in this report. The release information for 1989 reflects the changing goals of the FRED Division in that pink and chum salmon releases are decreased while other species are increasing or remaining static.

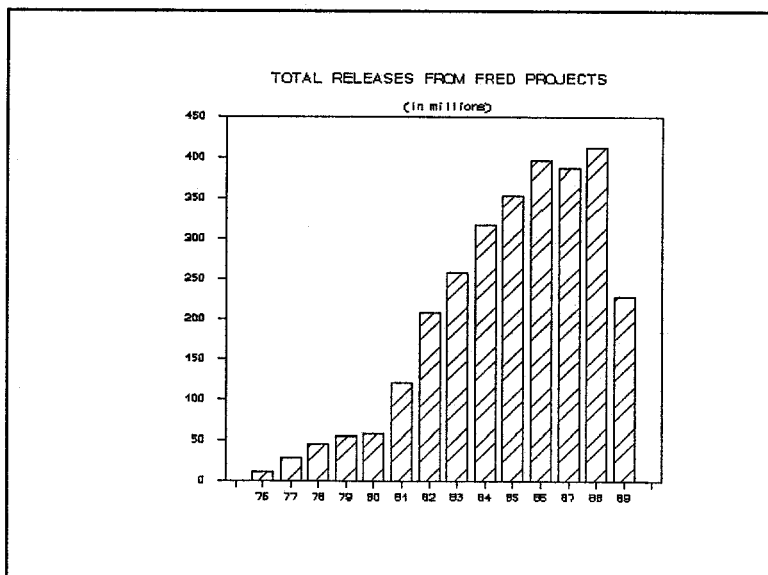


Figure 2

Egg-take information provided in Figure 3 indicates an increase in the number of eggs taken for FRED Division activities in 1989. Over 324.7 million eggs were taken in 1989 compared to 293.1 million taken in 1988. The low figure in 1988 reflected the transfer of hatchery operations, as egg takes followed this transfer. An increase in pink salmon eggs occurred in 1989 due to the tremendous increase in Kitoi Bay Hatchery returns. The taking of chinook salmon eggs dropped precipitously in 1989 primarily due to the hot, dry summer in southeast Alaska causing lethal water temperatures for adult spawners returning to Crystal Lake Hatchery. Sockeye salmon egg takes were scheduled to increase in 1989 but did not due to several egg takes either being decreased or cancelled due to weather and flooding. The continuing sockeye salmon initiative will cause dramatic increases in future sockeye salmon egg-take numbers.

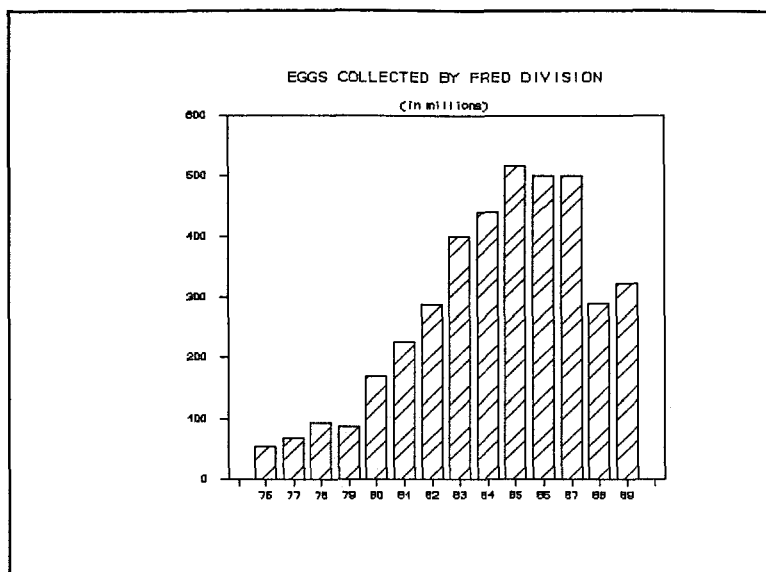


Figure 3

SOUTHEAST

Summary of FRED Projects

The FRED Division has three area offices and operates five hatcheries in southeast Alaska. A sixth state-owned hatchery in this region is operated by a PNP contractor. Area offices are located in Juneau, Petersburg, and Ketchikan. State-operated hatcheries in southeast Alaska include Snettisham, approximately 40 miles south of Juneau, Crystal Lake, on the road system outside of Petersburg, Deer Mountain and Beaver Falls in Ketchikan, and Klawock on Prince of Wales Island near the community of Klawock (Figure 4). Hidden Falls Hatchery on the east side of Baranof Island is owned by the state and operated under contract by the Northern Southeast Regional Aquaculture Association (NSRAA). In southeast Alaska, as well as in other regions of the state, FRED Division uses hatcheries as primary tools of enhancement, but employs many other strategies as well. In southeast Alaska, FRED Division uses many rehabilitation strategies, including fishpasses, spawning channels, lake fertilization, lake and stream stocking, and habitat restoration.

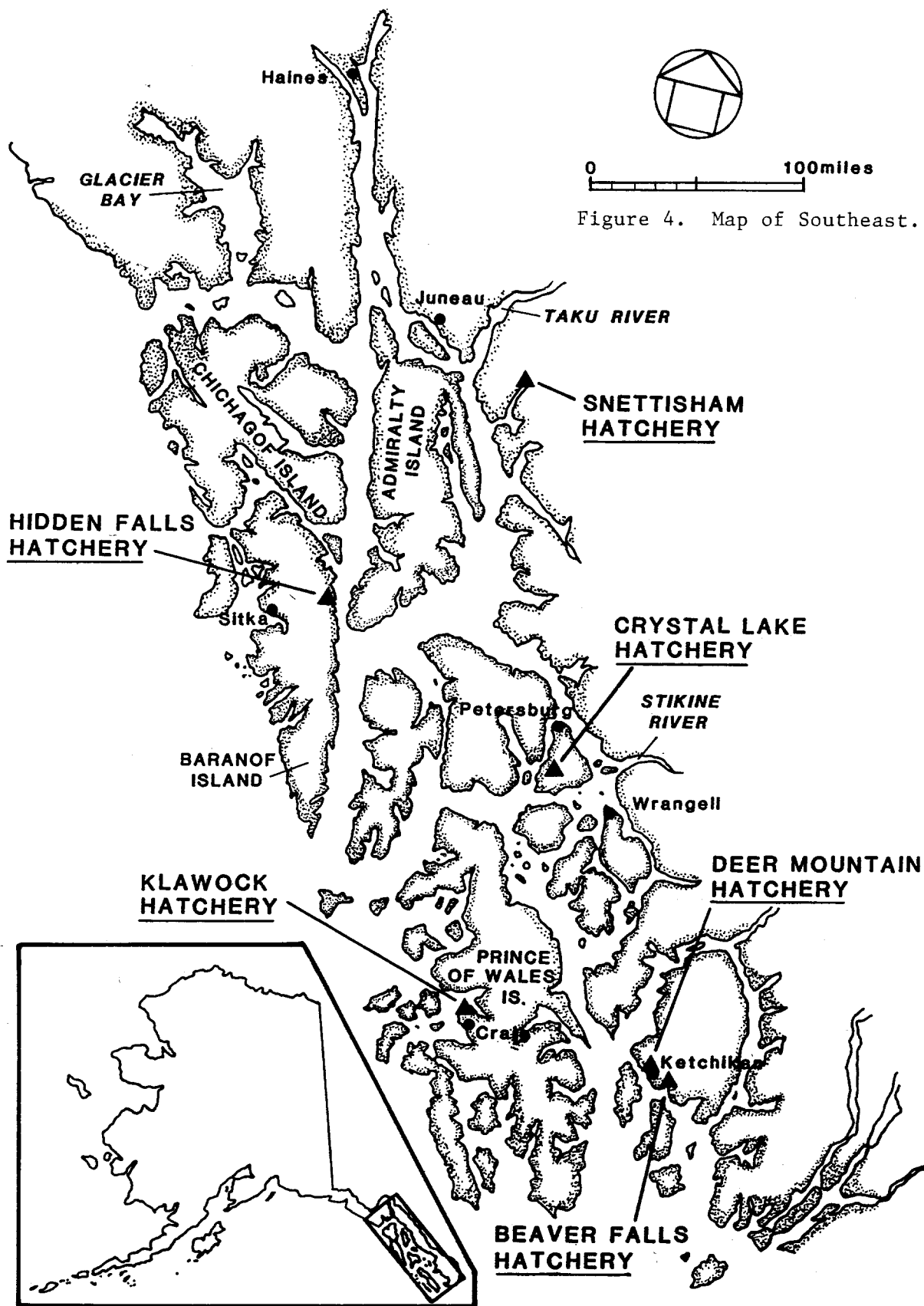
The Snettisham Hatchery is located at the head of Speel Arm in Port Snettisham and is approximately 30 air miles from Juneau. The facility is located at the outflow of a large hydroelectric facility which provides Juneau with a majority of its electricity. This facility also provides Snettisham Hatchery with two of its greatest assets—abundant, good quality water and inexpensive electricity. Snettisham was first operational in 1981, although pilot studies were started in 1976. In 1984 CIP funds were acquired to complete the hatchery. Full-production capacity is now 71.5 million chum salmon and 5.6 million chinook/coho salmon eggs.

In 1988 a major addition was built at the site to culture sockeye salmon. Construction of a 25 million-egg central incubation facility (CIF) for sockeye salmon is being provided to mitigate for a part of the U.S./Canada Pacific Salmon Treaty provisions. At present, a temporary incubation area is being used for sockeye salmon culture at an interim level of 10 million eggs.

In 1989 the Snettisham Hatchery crew took 2.9 million chum salmon eggs. This was far below the objective of 25 million eggs and is a consequence of an unanticipated poor return of two age classes. Chinook salmon egg takes at the hatchery were 150,000 with an additional 106,000 obtained from King Salmon River for transfer to Little Port Walter for subsequent broodstock development.

There were 426,000 coho salmon eggs collected in 1989. While the FRED Division management staff has elected to discontinue culture and release of this species at the hatchery, eggs were collected for lake stocking. In 10 years of work with coho salmon at Snettisham, their performance has consistently been below standards. Apparently, they are not well adapted to the low water temperature at this site.

Chum salmon survivals also have been below desired levels, although not to the same extent as the coho salmon. In 1988 a saltwater-rearing project was undertaken at Limestone Inlet that was designed to boost chum salmon survivals. It is expected that the warmer, more productive waters at Limestone Inlet will increase the survival rate of chum salmon to twice that of the hatchery release rate.



The sockeye salmon production phase of Snettisham Hatchery became operational in 1988 when a small number of eggs were collected at Speel Lake both to help rehabilitate that stock and also to assess several techniques to be employed in the CIF. One of these techniques is the chilling of incubation water to delay emergence of the fry until ice is off the designated stocking lake. The other technique is the thermal marking of the otoliths of developing embryos. It was shown that an identifying mark can be placed on the otoliths by sharply changing the water temperature during the incubation period. The successful use of this marking technique on sockeye salmon was a breakthrough for FRED Division's sockeye salmon program.

In 1989, 3.8 million sockeye salmon eggs were collected at Speel Lake and 0.6 million at Crescent Lake. These eggs will be used to rehabilitate these systems and augment sockeye salmon production. Additionally, 3.28 million eggs were received from Tahltan Lake on the Stikine River and will be returned next spring. The sockeye salmon program is one of the most promising at Snettisham Hatchery.

Crystal Lake Hatchery is located 17.5 miles south of Petersburg on the Mitkof Highway. The hatchery began operation in 1972 and is designed for long-term rearing of salmon and trout. Currently, the capacity of the hatchery is 1.3 million chinook salmon smolts, 100,000 coho salmon smolts, and 43,000 steelhead trout smolts. This results in an expected return of 60,000 adult chinook salmon, 8,100 adult coho salmon, and 2,000 adult steelhead trout. An isolation incubation and rearing facility was added in 1983. Each of the three isolation modules is capable of incubating 200,000 eggs, rearing 60,000 fry to 2 g, or 12,000 to 10 g. The isolation modules produce fish to stock underutilized habitats in cooperative projects with NSRAA, the Southern Southeast Regional Aquaculture Association (SSRAA), and the U.S. Forest Service. Annually, 500,000 chinook salmon smolts from Crystal Lake Hatchery are taken to the Earl West Cove remote-release site in a cooperative project with NSRAA, SSRAA, and the USFS.

Crystal Lake Hatchery chinook salmon production will peak by the mid-1990s at about 60,000 adults per year. This is 22% of the chinook salmon enhancement goal established in the Southeast Comprehensive Salmon Plan. Though Crystal Lake Hatchery is located within the boundary established for southern Southeast planning, these fish primarily will be harvested in northern Southeast waters. The FRED Division will continue to monitor alternate chinook salmon smolt release sites at Earl West Cove and Ohmer Creek for harvest rates and overall survival. Preliminary projections for Crystal Lake Hatchery returns in 1990 are: chinook salmon-Crystal Creek, 15,700, Ohmer Creek, 700, and Earl West Cove, 6,100; coho salmon, 8,000; and steelhead trout, 50 fish. These projections are summarized in Table 4.

Deer Mountain Hatchery in Ketchikan produces chinook and coho salmon primarily aimed at area sport fisheries. The majority of the fish reared at Deer Mountain are released at remote sites. The second year of releasing one-check chinook salmon smolts on Prince of Wales Island occurred in 1989. These fish were transported from Ketchikan to the Thorne Bay rearing site by a seine boat. After 13 days of rearing at the Thorne Bay site, the fish grew from 14 g in weight and 106 mm in length to 20 g and 115 mm, and were then released. Community interest was very good again this year. Adult production should exceed 1,200 fish from this release.

Only one site was stocked with fish from Deer Mountain Hatchery in 1989, as the second batch of chinook salmon had an outbreak of bacterial kidney disease and could not be transported to the Big Salt Lake estuary near Klawock for rearing and imprinting.

Deer Mountain Hatchery currently is culturing 178,000 chinook salmon fingerlings. These fish will be released at Ketchikan Creek, Big Salt Lake, and Thorne Bay. The two remote release groups have 68,000 fingerlings reserved for a May 1990 transport.

The Beaver Falls Hatchery, a central incubation facility (CIF) near Ketchikan, cultured sockeye salmon eggs from Hugh Smith and McDonald Lakes in 1989. Adult production from the releases made in 1989 should exceed 142,000 sockeye salmon. Beaver Falls originally was designed as a chum salmon facility but has recently undergone major modifications to change its operational mode to a CIF, responding primarily to FRED Division's sockeye salmon initiative in southeast Alaska. It has the capability of culturing five different stocks in complete isolation and delivering fry to area lakes for rearing.

In a second year of a study of saltwater fungal control on sockeye salmon eggs, the study design was scaled-up to standard production densities and egg numbers per lot. Increasing the hardness of water and using sea water as a control for white spot disease was the secondary research item being evaluated in this experiment.

Klawock Hatchery, near Klawock on Prince of Wales Island, maintained its coho salmon and steelhead trout production and continued its entry into sockeye salmon production. Klawock sockeye salmon had another poor natural stock escapement with only 3,234 fish reported. Sockeye salmon egg takes at Klawock were thus unsuccessful in fulfilling production needs. Coho salmon returns to Klawock Hatchery were good, with egg takes meeting production needs.

Approximately 150,000 sockeye salmon adults will be produced from the 1989 brood now incubating at Beaver Falls Hatchery. Klawock has an estimated 918,000 sockeye salmon eggs on inventory that should produce about 16,000 adults from the 1989 brood year. This represents a reduction of 46,000 fish in potential adult production from the 1988 brood year releases. Getting the sockeye salmon program into higher production levels will be a challenging problem to solve. A divisional plan for sockeye salmon identifies the Klawock Lake stocking and natural fry needs at 6-8 million fish annually. To meet egg-take goals of 8 million annually, adults will be allowed to migrate into Klawock Lake and egg takes will be conducted at Three Mile Creek. To increase production and survival, a rearing program will be incorporated for approximately half of the annual fry production. At 1 g, the sockeye salmon fry will be released into Klawock Lake. A limnology program will be reinitiated to resolve sockeye and coho salmon interactions in Klawock Lake and carrying-capacity questions. Subsistence sockeye salmon fisheries in Klawock Inlet continue to be problematic with escapement needs for both hatchery and wild-stock production. The Commercial Fisheries Division Area Biologist estimated that the Klawock sockeye salmon subsistence harvest of wild fish for 1989 was 3,000-4,000 fish.

FRED Division personnel cooperated with other agencies, primarily the USFS and PNP enhancement groups, in many nonhatchery projects in 1989. Fishpass projects were particularly evident in the southern and central areas of the region.

Sunny Creek - During escapement surveys in 1989, 12,400 pink, 185 chum, and 3 coho salmon were counted. The Alaska steppass design is serving the site's needs very well and is probably the most successful fishpass project in the Prince of Wales area.

Tunga Lake - The USFS planned to evaluate coho salmon escapement and juvenile carryover and production. This joint project with the USFS has been dropped. Adult coho salmon returns from the Tunga project to the commercial fisheries were 1,000 fish.

Bakewell Lake - The USFS established a weir operation at the head of the fishpass and enumerated sockeye and coho salmon returns in 1989. Limnology personnel worked with the USFS on this project and will report the results in their FRED southern Southeast cooperative project section of this report.

Margaret Creek - Construction of an Alaska steepass design (A-40) with a turning pool located off the streambed in a natural trench formation was completed in 1989. The ladder provides access to a 145-acre lake and feeder tributary for coho, pink, and sockeye salmon and steelhead trout. Summer coho salmon presmolts (40,000) were scheduled for a fall 1989 planting, but due to a USFS cutthroat trout study, the coho salmon stocking has been delayed until 1990. Approximately 500,000 Naha sockeye salmon fry were planted into Margaret Lake in 1988. After extensive predation, some 56,000 fish survived according to Limnology Section studies. Margaret Lake will accommodate annual plants of 200,000-250,000 McDonald sockeye salmon fry. Summer coho salmon presmolts (40,000) will be stocked using the Reflection Lake stocks. Steelhead trout stocks are rumored to be found downstream of the fishpass area and, if found in sufficient numbers, may be used for future supplemental programs in and above Margaret Lake.

Rio Roberts Creek - The USFS completed construction of the first fishpass in 1988, and additional fishpass work in the watershed needs to be completed next year. The Alaska steepass (A-40) was designed with two sections and a turning pool at the apex. The fishpass makes approximately 2 miles of upstream habitat available to coho salmon. Eggs taken from Rio Roberts Creek coho salmon were incubated at Klawock Hatchery. Klawock Hatchery staff stocked 12,000 coho salmon presmolts in September 1989. The goal is to get up to 70,000 eggs from remote egg takes to supply 60,000 fry. Smolt production from these fry should be excellent because the planting site is 2 miles upstream in an area of large pools and beaver ponds. Adult returns, when at full production, should exceed 3,000 coho salmon. The upper portion of this watershed is partially logged. An escapement survey in 1989 indicated natural production of coho salmon occurs in limited numbers above the fishpass.

Dog Salmon Creek - The Dog Salmon Creek fishpass is a 50-ft-long Alaska steepass that is positioned beside the creek. The site is located 0.6 miles upstream from Polk Inlet tidewater. The site is accessed by a logging road and cost \$150,000. This was a unique partnership project in which the Ketchikan Pulp Company and other private corporations paid approximately \$75,000 of the cost in addition to \$75,000 by the USFS. FRED was contracted by the USFS to do the limnetic surveys and assess the bioenhancement needs. Sockeye and coho salmon were found in the lake by limnology staff, while area office escapement surveys on 6 September counted 3,802 pink, 12 chum, and 3 coho salmon adults. Several yearling and young-of-year coho salmon were observed. No bioenhancement is recommended. The fishway accesses 2 miles of spawning habitat for pink and chum salmon. The economic benefit per year is estimated at \$43,000.

Cable Creek - The fishpass at Cable Creek is a pool-and-weir type fabricated of concrete. Some 47,000 presmolt coho salmon were stocked in August 1989, approximately 3 miles upstream from tidewater. Beaver ponds and large pools are the habitat type where the fish plants are made. Excellent survival is predicted, and 2,000 coho salmon adults could be produced.

Marten River - The fish ladder at Marten River was built in 1987 and consists of a series of pools blasted from rock. Only coho salmon have been observed upstream from the ladder. Plans to take eggs from Dick's Creek, incubate them at Beaver Falls, and return fry the following spring are being considered.

Big Lake - A potential barrier on the outlet stream from Big Lake, found by a USFS biologist, was hypothesized to stop coho and sockeye salmon migrations. The FRED limnology team surveyed Big Lake, upstream of the supposed barrier, and found both species rearing in the lake in good numbers. FRED surveys indicate that sufficient coho and sockeye salmon escapement occurs. The partial barrier seems to increase predation by bears on both stocks. Pink and chum salmon are found below the partial barrier. A fishpass, to be built in 1991, is being designed by the USFS.

Old Franks Lakes - A fishpass on the outlet stream to Old Franks Lake is scheduled for construction in 1990 if agreements between the USFS, Sealaska, Kavilco Native Corporation, and the State of Alaska can be made. Several private corporations will be brought into this project as partners as well as the Ketchikan Sports and Wildlife Club, which is interested in contributing labor, equipment, and expertise to the project. Some 1 million coho salmon fry, 500,000 sockeye salmon fry, and 30,000 steelhead trout smolts could be planted for up to five years to establish new runs for existing fisheries; 20,000-40,000 coho salmon adults, 12,000 sockeye salmon adults, and 1,200-3,000 steelhead trout adults could be produced annually from this project. The estimated cost is \$200,000 for construction of the fishpass and \$73,400 for bioenhancement costs.

Suntaheen River - In 1989 the USFS built a fish ladder alongside a barriered tributary of the Suntaheen River. The northern Southeast office is assisting them with efforts to bioenhance the river above the barrier. Efforts to collect eggs from coho salmon in the lower drainage were unsuccessful in 1989 due to a low escapement. Staff will work with the USFS to develop and implement other strategies in 1990.

Irish Creek-Upper Keku Creek - Irish Creek and Upper Keku Creek fishways were built by the USFS in 1984 and 1985, respectively, and are in the same watershed. FRED Division funded approximately 10% of the Irish Creek fishway construction and 100% of the fish-stocking costs. There was little direct monitoring of fish returns in 1989, but historical evidence suggests Irish Creek generated 3,000 or more coho salmon in 1989 (Table 1). The USFS and central Southeast FRED Division staff combined forces during the spring of 1989 to trap and tag 5,000 coho salmon smolts to improve estimates of adult contributions from this project. These tagged fish will enter the 1990 fisheries.

Dean Creek - FRED and USFS personnel entered the sixth year of coho salmon bioenhancement on the Dean Creek fishway project. A total of 2,700 juvenile coho salmon were captured in three donor streams and distributed throughout Dean

Table 1. Estimated contribution of fish by FRED hatcheries and projects in 1989.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis- tence	Brood Stock/ Escapement	Total	Comments
ARCTIC-YUKON-KUSKOKWIM								

Clear	Coho	55	55			55	165	
	Chum	2,000				2,000	4,000	
	Chinook	25	25			50	100	
Interior lakes	Coho		32,300				32,300	See footnote.
	Rainbow		60,000				60,000	See footnote.
	Grayling		26,000				26,000	See footnote.
	A char		1,000				1,000	
Fort Richardson								
Interior lakes	Rainbow		30,000				30,000	See footnote.
Sikusullaq	Chum	14,000			2,000	6,000	22,000	
AYK TOTALS:		16,080	149,380	0	2,000	8,105	175,565	
COOK INLET								

Big Lake								
Big Lake	Sockeye	101,000		8,000		55,100	164,100	
	Coho	3,800	600	100		1,500	6,000	
Cottonwood Cr Dr.	Coho	630	315			315	1,260	
Little Susitna R	Coho	630	315			315	1,260	
Wasilla Creek	Coho	260	130			130	520	
Jim Creek	Coho	300	150			150	600	
Rabbit Slough	Coho	250	125			120	495	
Landlocked Lakes	Coho		17,000				17,000	

Table 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis- tence	Brood Stock/ Escapement	Total	Comments
Crooked Creek								
Crooked Creek	Chinook		1,940			960	2,900	
	Coho		1,100			3,470	4,570	
	Steelhead		60	10		45	115	
Tustumena Lake	Sockeye	208,000	500	3,300		52,300	264,100	
Leisure Lake	Sockeye	79,700	8,000			1,300	89,000	With Chenik L.; 73% of LCI sockeye
Chenik Lake	Sockeye		200			50,700	50,900	Bstock includes 38.9K cost recovery
Elmendorf								
Crooked Creek	Chinook	0	3,990	125		1,930	6,045	In addition to Crooked Creek Hatchery
Halibut Cove	Chinook	1,420	1,600				3,020	
Homer Spit	Chinook		3,000				3,000	
	Coho		2,500				2,500	
Seldovia	Chinook		900			50	950	First year of returns.
Ship Creek	Chinook		300				300	
	Coho		300				300	
Resurrection Bay	Coho		4,840			5,110	9,950	
	Chinook		825			200	1,025	
Fort Richardson								
Willow Creek	Chinook	200	925			1,100	2,225	
Little Susitna	Coho	20,600	12,600			8,000	41,200	
Cook Inlet lakes	Rainbow		114,000				114,000	See footnote.
	Coho		8,000				8,000	
Tutka Bay Lagoon								
Kachemak Bay	Pink	628,000	10,000			62,900	700,900	99% (with HCL) of LCI pink harvst
	Chum	2,000					2,000	
Halibut Cove	Pink	249,000	500			100	249,600	
Ingram Creek	Pink	200	200				400	
Homer Spit	Pink		10,000				10,000	

Table 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis- tence	Brood Stock/ Escapement	Total	Comments
Clear								
Landlocked lakes	Grayling		3,500				3,500	See footnote.
	A Char		4,500				4,500	See footnote.
COOK INLET TOTALS:		1,295,990	212,915	11,535	0	245,795	1,766,235	
KODIAK/ALASKA PENINSULA								

Kitoi Bay	Pink					7,620,000	7,620,000	Note: Commercial catch affected by Exxon-Valdez Oil Spill Bstock includes 6.5M cost-recovery
	Chum					3,500	3,500	
	Coho					1,000	1,000	
Kodiak Lakes	Coho		3,000			1,000	4,000	See footnote.
Landlocked lakes	Coho		1,000				1,000	See footnote
	Grayling		500				500	
Karluk	Sockeye					35,000	35,000	
Frazer fishpass	Sockeye	800,000				360,000	1,160,000	Fishpass operated by Comm Fish
Afognak Fishpasses	Coho					11,900	11,900	See footnote. Operated by Comm Fish
(combined)	Pink					59,000	59,000	See footnote. Operated by Comm Fish
	Sockeye					12,600	12,600	See footnote. Operated by Comm Fish
Waterfall Fishpass	Pink					117,000	117,000	See footnote.
Russell Creek	Chum					15,000	15,000	See footnote.
	Pink					90,000	90,000	
KODIAK/AK PEN TOTALS:		800,000	4,500	0	0	8,326,000	9,130,500	

Table 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis- tence	Brood Stock/ Escapement	Total	Comments
PRINCE WILLIAM SOUND								Note: Commercial catch affected by Exxon-Valdez Oil Spill
Hobo Creek	Pink					400	400	
Elmendorf								
Whittier	Coho		1,000				1,000	
Fort Richardson								
Cordova	Coho		3,000				3,000	
PWS Lakes	Rainbow		2,100				2,100	See footnote.
	Coho		500				500	See footnote.
Gulkana	Sockeye	127,000	few			84,600	211,600	Bstock includes Subs and Pers use
Main Bay	Sockeye			3,000			3,000	1-ocean jacks
	Chum	15,000				115,000	130,000	Mostly cost-recovery
Clear	Grayling		5,000				5,000	
	A Char		1,000				1,000	
PWS TOTALS:		142,000	12,600	3,000	0	200,000	357,600	
SOUTHEAST REGION								
SOUTHERN								
Bakewell	Coho	2,260	273			564	3,097	Fishpass. See footnote.
	Sockeye	920				230	1,150	
Cable Creek	Coho	18				5	23	See footnote.
Deer Mountain	Chinook	200	181	177		983	1,541	
	Coho	274	49			180	503	

Table 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis- tence	Brood Stock/ Escapement	Total	Comments
Dog Salmon	Pink					3,800	3,800	1st year opened, no catch
	Chum					12	12	in comm fishery, coop USFS project
	Coho					3	3	
Marx Creek-Hyder	Chum	25,000				8,400	33,400	Coop spawning channel w/ USFS. See footnote
Hugh Smith Lake	Sockeye	552				113	665	
Ketchikan Creek	Pink	243,000	4,000			40,500	287,500	Fishpass. See footnote
Klawock	Chum	4,160			12	64,600	68,772	
	Coho	20,700	4,300	1,130		12,400	38,530	
	Steelhead		640			40	680	
McDonald Lake	Sockeye	35,200			2,230	36,900	74,330	
Sunny Creek	Pink	56,800				14,200	71,000	Fishpass. See footnote
	Chum					185	185	
	Coho					3	3	
Tunga Lake	Coho	1,040				300	1,340	See footnote.
Ward Creek	Coho	776	126			500	1,402	Reared at Deer Mtn Hatchery. See footnote
	Steelhead		186			200	386	
CENTRAL								
Crystal Lake	Chinook	3,680	1,610			5,600	10,890	
	Coho	3,180	230	40		2,350	5,800	See footnote
	Steelhead					21	21	
Earl West Cove	Chinook	2,890	50				2,940	Joint release with SSRAA
Farragut	Chinook	175	12			4	191	
Harding River	Chinook	6				1	7	
Irish Creek	Coho	1,000				2,000	3,000	Fishpass
Ohmer Creek	Chinook	590	100			475	1,165	
Slippery Creek	Coho	452					452	
St. John's Creek	Coho	23					23	

Table 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis- tence	Brood Stock/ Escapement	Total	Comments
NORTHERN								
Chilkat Ponds	Coho	1,000				250	1,250	
Eliza Lake	Chinook	10					10	
Indian Lake	Coho	672	68			400	1,140	
Juneau/DJ	Chinook	436	807			177	1,420	Juneau/DJ = Fish Cr, Sheep Cr, Twin Lakes
	Coho	5,250	4,710			6,100	16,060	Montana Cr, Auke Cr, Dredge L,
Snettisham	Chinook	234	61			122	417	
	Coho	1,510	177			720	2,407	
	Chum	4,000				2,800	6,800	
Sweetheart Lake	Coho	237	3			130	370	
Tahini River	Chinook	40	8			100	148	
Southeast Totals:		416,285	17,591	1,347	2,242	205,180	642,645	
STATE TOTALS:		2,670,355	396,986	15,882	4,242	8,985,080	12,072,545	
BY SPECIES:		Chinook	38,294		Steelhead	1,202		
		Coho	223,920		Rainbow	206,100		
		Chum	285,484		Grayling	35,000		
		Sockeye	2,066,445		A Char	6,500		
		Pink	9,209,600					
			11,823,743			248,802		

Footnote: Most estimates are based upon a combination of historical data, standard survival assumptions, and minimal or no sampling. Landlocked lakes estimates are approximately the same as reported in the 1988 Statewide Sport Fisheries Harvest Report.

Creek. In all, 48,100 coho salmon fry have been planted into Dean Creek. The first evidence of natural production was documented in Dean Creek in 1988 when both coho salmon fry and an adult were seen above the fishway. Dean Creek fishway was built by the USFS in 1983.

Slippery Creek - A joint effort by FRED, NSRAA, and the USFS distributed 59,100 fed and 319,000 unfed coho salmon fry throughout the upper watershed of Slippery Creek in 1989 (Table 2). A total of 179,000 fed fry and 580,000 unfed fry have been released into Slippery Creek during the past three years. Crystal Lake Hatchery personnel took an additional 150,000 coho salmon eggs in 1989 for this project as part of a USFS, Forest Science Lab study. Tag recoveries indicate 452 adult coho salmon entered the fisheries this year (See Table 1). The USFS constructed a fishway on this system in 1988.

St. John's Creek - The USFS built the St. John's fishway in 1986. Coho salmon bio-enhancement efforts on St. John's Creek were initiated in 1985 and, through 1987, less than 24,000 fry had been introduced above the barrier. A committee of local ADF&G, NSRAA, SSRAA, and USFS personnel recommended use of hatchery stocks in 1988. Permission was granted to use Crystal Lake Hatchery coho salmon eggs fertilized with milt obtained from St. John's Creek coho salmon stocks. This resulted in 76,500 fed fry being released in 1989. Another 100,000 eggs are being incubated at Crystal Lake Hatchery for fry releases in 1990. The first tagged coho salmon were recovered from this project in 1989 with an estimated contribution of 23 fish to the fisheries (See Table 1).

Mill Creek/Virginia Lake - The USFS constructed a fishway on Mill Creek in 1988 providing access to Virginia Lake, which is on the mainland across Eastern Passage from the town of Wrangell. Virginia Lake is approximately 600 acres in size with the potential to produce up to 60,000 adult sockeye salmon. A small indigenous stock of sockeye salmon already exists in the system, but bioenhancement using McDonald Lake stocks was recommended and approved. The FRED Division Beaver Falls Hatchery in Ketchikan is incubating McDonald Lake sockeye salmon eggs for release into Virginia Lake.

Harding River - The USFS and central Southeast FRED fisheries staff also are looking at providing chum salmon access to the Harding River above the canyon. As part of the data-gathering process, 18,000 chum salmon fry were tagged during the past two seasons to determine where these fish are contributing to our fisheries. FRED staff collected and placed 123,000 green eggs (Table 3) in instream incubation boxes in the upper Harding River to imprint fry to the area above the canyon. Fishery personnel will observe the imprinted chum salmon adults to monitor their movement in the canyon. The upper Harding River has significant potential to produce chum as well as chinook salmon. Because the canyon is formidable, FRED staff will use the fish to see what they are capable of before proceeding. If the instream incubation is successful, it also would provide an important alternative for future bioenhancement in the Harding River.

Spawning channel projects in southeast Alaska in which FRED Division personnel participated in 1989 include the following:

Marx Creek Spawning Channel - U.S./Canada grant support ended on 30 June 1989. The four major activities accomplished involved adult transplants in 1988, pre-emergent fry sampling in late winter of 1989, and fry tagging and enumeration

Table 2. Number of fish released during 1989 by FRED facilities.

Facility	Brood year, Stock	Species	Released
ARCTIC/YUKON/KUSKOKWIM			
Clear	1987	Aleknagik L	Arctic Char 13,000
	1988	Aleknagik L	Arctic Char 72,000
	1988	Wood Cr	Coho 737,000
	1989	Moose L	Grayling 1,570,000
	1988	Paxon L	Lake Trout 94,000
	1988	Swanson R	Rainbow 113,000
	1989	Swanson R	Rainbow 425,000
	1988	Koy-Yukon Mix	Sheefish 110,000
Sikusuilaq	1988	Noatak R	Chum 6,052,000
ARCTIC/YUKON/KUSKOKWIM:			9,186,000
COOK INLET			
Big Lake	1986	Big L	Coho 450
	1987	Big L	Coho 74,000
	1988	L Susitna R	Coho 8,400
	1988	Meadow Cr	Sockeye 13,200,000
Crooked Cr	1987	Crooked Cr	Coho 71,000
	1988	Glacier Flats	Sockeye 15,200,000
	1987	Crooked Cr	Steelhead 91,000
Elmendorf	1988	Crooked Cr	Chinook 1,250,000
	1988	Ship Cr	Chinook 90,000
	1987	Bear L	Coho 280,000
	1988	Bear L	Coho 237,000
	1987	Ship Cr	Coho 57,000
	1988	Ship Cr	Coho 15,000
Ft Richardson	1988	Ninilchik R	Chinook 200,000
	1988	Willow Cr	Chinook 680,000
	1987	Caswell Cr	Coho 162,000
	1988	Caswell Cr	Coho 169,000
	1987	Fleming Spit	Coho 152,000
	1988	Fleming Spit	Coho 82,000
	1987	L Susitna R	Coho 359,000
	1988	L Susitna R	Coho 333,000
	1985	Big L	Rainbow 113

Table 2. Continued.

Facility	Brood year,	Stock	Species	Released
	1989	Big L	Rainbow	539,000
	1985	Swanson R	Rainbow	19
	1986	Swanson R	Rainbow	456
	1988	Swanson R	Rainbow	283,000
	1989	Swanson R	Rainbow	2,670,000
Tutka Bay	1988	Tutka Bay	Chum	2,160,000
	1988	Tutka Bay	Pink	37,000,000
		COOK INLET		75,363,438
KODIAK & AK PENINSULA				
Kitoi	1988	Big Kitoi Cr	Chum	3,290,000
	1988	L Kitoi L	Coho	530,000
	1988	Big Kitoi Cr	Pink	80,500,000
	1988	U Station L	Sockeye	144,000
Russell Cr	1987	Mortenson Cr	Coho	34,000
	1988	Russell Cr	Pink	1,900,000
	1988	Mortenson Cr	Sockeye	932,000
		KODIAK & AK PENINSULA		87,330,000
PRINCE WILLIAM SOUND				
Gulkana I & II	1988	Gulkana R	Chinook	16,000
	1988	Gulkana R	Sockeye	26,500,000
Main Bay	1987	Coghill L	Sockeye	3,920,000
	1988	Coghill L	Sockeye	758,000
		PRINCE WILLIAM SOUND		31,194,000
SOUTHEAST				
Beaver Falls	1988	Hugh Smith L	Sockeye	533,000
	1988	McDonald L	Sockeye	5,370,000

Table 2. Continued.

Facility	Brood year, Stock		Species	Released
Crystal Lake	1987	Crystal Cr	Chinook	1,100,000
	1987	Crystal Cr	Coho	108,000
	1988	Crystal Cr	Coho	800,000
Deer Mountain	1987	Ketchikan Cr	Chinook	191,000
	1987	Reflection L	Coho	128,000
	1988	Reflection L	Coho	85,000
	1989	Ketchikan Cr	Steelhead	19,000
Klawock	1988	Cable Cr	Coho	47,000
	1988	Klawock R	Coho	1,340,000
	1987	Klawock R	Coho	1,160,000
	1988	Rio Roberts Cr	Coho	12,000
	1988	Klawock R	Sockeye	2,470,000
	1988	Klawock R	Steelhead	89,000
Marx Cr Spwn Ch	1988	Fish Cr	Chum	4,210,000
Snettisham	1987	Crystal Cr	Chinook	475,000
	1987	King Salmon R	Chinook	72,000
	1987	Snettisham	Chinook	677,000
	1988	Snettisham	Chum	6,400,000
	1985	Snettisham	Coho	9,400
	1986	Snettisham	Coho	195,000
	1988	Speel L	Sockeye	224,000
SOUTHEAST				25,714,400
Species totals:				
			Chinook	4,751,000
			Coho	7,185,250
			Chum	22,112,000
			Sockeye	69,251,000
			Pink	119,400,000
			Rainbow	4,030,588
			Steelhead	199,000
			Grayling	1,570,000
			Arctic Char	85,000
			Lake Trout	94,000
			Sheefish	110,000
				228,787,838

Table 3. Estimated number of eggs taken by FRED division during 1989

Facility	Broodstock	Species	Eggs Taken
ARCTIC/YUKON/KUSKOKWIM			
Clear	Aleknagik L	Arctic Char	488,000
	Moose L	Grayling	2,798,000
	Paxon L	Lake Trout	125,000
	Koy-Yukon Mix	Sheefish	488,000
Sikusuilag	Noatak R	Chum	9,177,000

			13,076,000
COOK INLET			
Big Lake	Meadow Cr	Coho	2,100,000
	L Susitna R	Coho	1,200,000
	Meadow Cr	Sockeye	14,800,000
Broodstock Dev Center	Swanson/Big L	Rainbow	6,166,000
Crooked Creek	Crooked Cr	Chinook	1,300,000
	Kasilof R	Chinook	400,000
	Ninilchik R	Chinook	275,000
	Crooked Cr	Coho	581,000
	Glacier Flats	Sockeye	17,500,000
	Crooked Cr	Steelhead	130,000
Elmendorf	Crooked Cr	Chinook	1,164,000
	Bear L	Coho	288,000
	Ship Cr	Coho	98,000
Ft Richardson	Willow Cr	Chinook	1,543,000
	Caswell Cr	Coho	188,000
	Fleming Spit	Coho	253,000
	L Susitna R	Coho	570,000
Tutka Bay	Tutka Bay	Chum	2,130,000
	Tutka Bay	Pink	43,335,000
	English Bay	Sockeye	427,000

COOK INLET			94,448,000

Table 3. Continued.

Facility	Broodstock	Species	Eggs Taken
KODIAK & AK PENINSULA			

Kitoi	Big Kitoi Cr	Chum	2,150,000
	L Kitoi L	Coho	90,000
	Big Kitoi Cr	Pink	120,000,000
	U Station L	Sockeye	5,300,000
Russell Creek	Russell Cr	Chum	16,000,000
	Mortenson Cr	Coho	35,000
	Russell Cr	Pink	10,000,000
KODIAK & AK PENINSULA			-----
			153,575,000
PRINCE WILLIAM SOUND			

Gulkana	Gulkana R	Chinook	60,200
	Gulkana R	Sockeye	36,400,000
Main Bay	Coghill L	Sockeye	2,980,000
PRINCE WILLIAM SOUND			-----
			39,440,200
SOUTHEAST			

Beaver Falls	Hugh Smith L	Sockeye	2,280,000
	McDonald L	Sockeye	4,680,000
Crystal Lake	Crystal Cr	Chinook	1,720,000
	Harding R	Chinook	111,000
	Crystal Cr	Coho	700,000
	Crystal Cr	Steelhead	44,000
Deer Mountain	Ketchikan Cr	Chinook	361,000
	Reflection L	Coho	227,000
	Ketchikan Cr	Steelhead	36,000
Harding R Streamside Inc	Harding R	Chum	123,000
Klawock	Cable Cr	Coho	82,600
	Klawock L	Coho	1,560,000
	Rio Roberts	Coho	56,000
	Klawock L	Sockeye	918,000
	Klawock R	Steelhead	84,000

Table 3. Continued.

Facility	Broodstock	Species	Eggs Taken
Snettisham CIF	Crescent L	Sockeye	551,000
	Speel L	Sockeye	3,750,000
	Tahltan L	Sockeye	3,280,000
Snettisham	King Salmon R	Chinook	106,000
	Snettisham	Chinook	150,000
	Snettisham/KSR	Chinook	10,000
	Snettisham	Chum	2,900,000
	Snettisham	Coho	426,000
Southeast total:			24,155,600
Species totals:			
		Chinook	7,200,200
		Coho	8,454,600
		Chum	32,480,000
		Sockeye	92,866,000
		Pink	173,335,000
		Rainbow	6,166,000
		Steelhead	294,000
		Grayling	2,798,000
		Arctic Char	488,000
		Lake Trout	125,000
		Sheefish	488,000
STATE TOTAL:			324,694,800

using an electronic fry counter. Water temperature data collection continued using the digital-recording thermographs at two-hour intervals.

Approximately 5,279 adult chum salmon were transferred into the seven controlled-density cells in the upper portion of the spawning channel. Natural escapement into the lower portion of the channel was 3,890 chum salmon. Using the electronic counter to count fry as they emigrated from the channel, staff estimate a survival in excess of 42%. Therefore, a total of 4.2 million fry were produced by the Marx Creek Spawning Channel in 1989. Adult production, assuming 2% for marine survival, would be 84,000 adult chum salmon returning to fisheries and escapement.

The USFS extended the channel another 1,500 lineal feet which will essentially double the productive section of the channel in 1989. The USFS has contracted FRED Division to complete the preemergent sampling and fry enumeration using the electronic counter.

Fish Creek Spawning and Rearing Channel - Another spawning and rearing channel is planned for the Hyder area. USFS monies and staff are being committed to this project. An old streambed or oxbow of the Salmon River that parallels Fish Creek is the subject area for this work. By using natural gradients, improving pool-riffle types, and using natural habitat systems, a very productive trout and coho salmon project can be developed in the area. An automatic fish feeder system could supplement the natural food production system to enhance the productivity of the coho salmon channel. Preliminary planning and surveys have been accomplished in cooperation with the USFS during the year. Construction is possible in 1991.

Eagle River Rearing Channel - The northern Southeast office has applied habitat restoration and enhancement skills in a number of projects. One of these has been assisting the USFS in designing, constructing, and evaluating a coho salmon rearing channel on Eagle River near Juneau.

Lake- and stream-stocking projects undertaken by Southeast Region FRED Division personnel include:

Reflection Lake - Coho salmon fingerlings were released in Reflection Lake for the third year. Approximately 84,567 fingerlings were planted along the shoreline by hatchery personnel. A representative group was coded-wire-tagged at the hatchery before transport. A second stocking of summer-run coho salmon will be made late this fall because 54,500 presmolts originally scheduled for Margaret Lake will instead go into Reflection Lake. A representative number of these fish currently are being coded-wire-tagged at Deer Mountain Hatchery.

Margaret Lake - The Margaret Lake coho salmon stocking plan was revised to accommodate a USFS cutthroat trout research project. The first summer coho salmon plant will be made in 1990.

Ketchikan Creek - In May 1989, 73,000 summer coho salmon smolts were planted. A representative group was coded-wire-tagged for evaluation purposes.

Bold Island Lakes - A group of 30,000 summer coho salmon presmolts will be planted by late fall 1989. These fish originally were scheduled for Ward Lake, but due to

complications with carryover steelhead trout and wild-stock coho salmon and trout populations, regional and area staff believe the Ward Lake system is at carrying capacity. Additional stock information will be collected this fall to determine age and hatchery carryover problems at Ward Lake. Future use of the Ward Lake system for a summer coho salmon release site is planned. Adult returns from all 1989 releases of summer coho salmon are expected to be about 14,000 fish.

Indian River Stocking - A cooperative project continued in which FRED Division and the USFS had stocked Indian River near Tenakee with 269,000 chinook salmon from Snettisham Hatchery in three separate groups in 1988. The study to assess habitat utilization and production of stocked chinook salmon fry in stream and pond habitats continued in 1989 when the USFS monitored production.

Sweetheart Falls - As part of the increased emphasis on the valuable species of sockeye salmon and potential production from lake stocking, the northern Southeast office undertook assessment work on the Sweetheart Lake outlet. Because sockeye salmon smolts were not available, in 1988 a group of coho salmon smolts were tagged and released in the lake above the falls to test their ability to volitionally emigrate safely over the falls. The return rate of these fish, based on contributions in the 1989 fishery, was 1.4-times better than a similar group released at the hatchery. Staff concluded that the falls has little effect on survival of coho salmon smolts.

Turner Lake Assessment - ADF&G has proposed stocking Turner Lake with sockeye salmon fry. It is estimated that this lake could produce 500,000 adult sockeye salmon on an annual basis. While the economic benefits to commercial fisheries would be substantial, there are other concerns, including the maintenance of a popular cutthroat trout fishery, management of adult returns, particularly coho salmon, and the status of infectious hematopoietic necrosis virus (IHNV) in the lake. As the proposed project is in the Tongass National Forest, National Environmental Protection Agency laws apply and an Environmental Assessment (EA) was prepared by the northern Southeast office for the USFS. The EA was subsequently withdrawn due to the controversy about the project, and an Environmental Impact Statement is now being prepared.

The northern Southeast office also has played the lead role in sampling the Turner Lake kokanee population for the presence of IHNV. During the last two years, more than 220 ovarian fluids were collected from Turner Lake kokanee; they have been the most representative samples obtained from a kokanee population. No IHNV has been detected.

Cable Creek - In August 1989, some 47,000 presmolt coho salmon were planted into upper Cable Creek after a representative group was coded-wire-tagged. A return of 2,000 adults is expected from this release. Remote egg takes at Cable Creek in 1989 resulted in an estimated 83,000 eggs.

Tunga Lake - This was the last year of stocking for this system. Approximately 177,000 coho salmon presmolts were planted into this 200-acre system in 1989. Adult returns from this planting should exceed 9,200 fish.

Farragut River - Central Southeast personnel collected chinook salmon eggs on the Farragut River in 1983-1985. A total of 78 chinook salmon was obtained for

broodstock use. Eggs were incubated and the fry reared at Crystal Lake Hatchery. The fry were tagged and returned to rearing areas above the barrier on the Farragut River. In 1989 an estimated 187 chinook salmon (See Table 1) were harvested from this project. This project contributed an estimated 375 chinook salmon to Southeast fisheries during the past three years and will continue to contribute for another three years. A project proposal has been submitted to expand this project to annually produce 2,000-4,000 adult chinook salmon to the fisheries.

Harding River - FRED Division and the USFS entered into a joint agreement to evaluate chinook salmon habitat above a partial barrier on the Harding River south of Wrangell. Staff obtained and fertilized 47,600 chinook salmon eggs from 10 females and 16 males collected below the barrier in 1986. The eggs were incubated at Crystal Lake Hatchery and then 30,500 fed fry were tagged and released upstream of the barrier in May 1987. The net fisheries harvested an estimated six fish from this project in 1989 (See Table 1). This year central Southeast FRED personnel conducted a joint chinook salmon egg take on the Harding River in conjunction with the Burnett Inlet PNP Hatchery broodstock development. Collected were 111,000 green eggs (See Table 3) resulting in 34,600 eyed eyes for future habitat assessment and 50,300 eyed eggs for Burnett Inlet. Data will be used from the marine catch of fish resulting from the Harding River-releases to determine the efficacy of the plant, and use the behavior of the adults in the river to determine if and where a fishpass should be built to provide chinook salmon access above the barrier.

Ward Creek - In June 1989, 39,000 steelhead trout were planted in Ward Creek. The Ward Creek steelhead trout-stocking program will be discontinued.

Klawock Lake - Steelhead trout also were released into Klawock Lake in June 1989. Some 50,000 fish were planted into the upper reaches of the lake.

Habitat improvement projects are becoming a priority for the FRED Division. While this type of project includes many of those fishpass and lake fertilization projects already discussed, other projects that FRED Division personnel worked on in 1989 in southeast Alaska include:

Steelhead Creek - Modification of a log jam located approximately 2 miles upstream was tackled this season using a Bell 206 helicopter. In less than 4 hours and at a cost of \$10,200, the job was completed. Using a D-9 Cat and six people would have taken a minimum of six days. Included for this cost were five choker setters and one bushler, one pilot, and a crew boss. Some 40,000 pink salmon were estimated to have moved into the upper reaches of the creek before successfully spawning.

Ophir Creek - The Ophir Creek system has a history of low or no water in its upper reaches during the summer. This phenomenon is relatively new, having begun in the late 1960s. In response to concerns over this loss, FRED Division secured permits to construct several fry-refuge ponds in the impacted area. Four ponds were excavated in 1989 and are expected to provide sanctuary for the salmon fry during droughts. This project was a cooperative venture between the Department of Transportation and Public Facilities, the ADF&G, FRED, Sport Fish, and Commercial Fisheries Divisions, and the City of Yakutat. FRED had the lead role in the project.

Another of FRED Division's strategies is to provide appropriate research so that enhancement, rehabilitation, and development activities can be optimized.

Deer Mountain Triploidy Study - Some 15,000 triploid chinook salmon were released in the spring of 1989 from Deer Mountain Hatchery. The average weight at release was 18.3 g. Flow-cytometry testing indicated that 85% of the group were triploids. Coded-wire tags were placed in the entire group for future evaluation programs.

Deer Mountain Feeding Frequency Study - A group of chinook salmon, in which feeding frequencies were varied and compared, was released from Deer Mountain Hatchery this year. This was the second year that the incidence of bacterial kidney disease as a function of feeding and starving was studied.

Klawock Coho Salmon Rearing Density Trial - A study was designed to compare two rearing density groups, 0.75 lb/ft³ and 1.5 lb/ft³. The study design was modified because fish growth exceeded the planned growth. The new values should be about 1 lb/ft³ and 2 lb/ft³ and 20 g at release. Fish-quality indexing is an important part of this study. The fish will be released into Klawock Lake in mid-November after being coded-wire-tagged for evaluation purposes.

Klawock Coho Salmon Diet Trial - Coho salmon from two diet groups released in 1987 returned to Klawock Hatchery this year. The groups had been fed either Oregon Moist Pellet (OMP) or Rangen feed. Preliminary results are that 1.8% of the OMP group and 3.36% of the Rangen group survived to adult. Over 20,000 coho salmon have been caught in commercial fisheries and more than 10,000 coho salmon adults returned to the hatchery.

Southeast Highlights

- ° Over 15,000 triploid chinook salmon smolts were released from Deer Mountain Hatchery.
- ° The recent Hubbard Glacier ice dam, which threatened the Situk River drainage, has raised interest in FRED Division involvement in mitigation, restoration, and habitat protection in the Yakutat area.
- ° In 1989, 123,940 coho salmon smolts, 337,000 chinook salmon smolts, and 9,385, 6- to 8-inch coho salmon were stocked in the Juneau area. This is the fourth year that fish have been stocked in the Juneau area for this project. It also was the best year for returns. There were an estimated 807 chinook salmon caught by sport anglers as a result of this project in 1989.
- ° In response to concerns over the loss of fry-rearing habitat in Ophir Creek near Yakutat, FRED Division secured permits to construct several fry-refuge ponds in the impacted area. Four ponds were excavated in 1989 and are expected to provide sanctuary for the salmon fry during low water periods.
- ° A student intern from the Skagway City School's Pullen Creek Hatchery worked at the Snettisham Hatchery for a fourth year in 1989, as did a student from the Rural Student Vocational Program for the first time.

- ° The temporary Snettisham Hatchery sockeye salmon CIF has become operational and sockeye salmon enhancement activities on a number of lakes in northern Southeast will be initiated.
- ° The thermal marking of the otoliths of developing sockeye salmon embryos was accomplished at Snettisham Hatchery in 1989. An identifying mark can be placed on the otoliths by sharply changing the temperature during the incubation period. The successful use of this technique on sockeye salmon was a breakthrough for FRED Division's sockeye salmon program.
- ° Alaska hatchery chinook salmon contributions to the troll fishery in Frederick Sound is growing steadily, approaching 30% in the winter troll catch.
- ° Early harvest estimates of Alaska hatchery chinook salmon from three release sites indicate Crystal Lake Hatchery stocks provided approximately 7,160 of this prized species to southeast Alaska commercial fisheries in 1989.

Southeast Returns and Fishery Contributions

FRED projects produced a return of over 643,000 fish to southeast Alaska in 1989 (See Table 1). For the first time in this region, the dominant state project-produced fish was the pink salmon, accounting for 362,000 fish in Southeast in 1989. All state production of pink salmon in Southeast is attributed to fishpasses, with the major production being at Ketchikan Creek. In past years the dominant fish produced by state projects has been the chum salmon. With the transfer of operations of Hidden Falls Hatchery and the essential run failure of chum salmon at Snettisham in 1989, chum salmon were relegated to second place in 1989 with 109,000 produced. Major producers of chum salmon in Southeast are the Klawock Hatchery and the Marx Creek Spawning Channel project at Hyder. Chum salmon production at Klawock is being phased out and replaced by sockeye salmon. Sockeye salmon had the third-highest number of returns to FRED projects in Southeast this year. This is a portent of the future when sockeye salmon will comprise the major returns to FRED projects in Southeast. The sockeye salmon initiative, begun in 1987, will utilize hatchery, lake stocking, and lake enrichment to produce sockeye salmon in record numbers in Southeast. This is an indication of programmatic changes within the FRED Division in which pink and chum salmon production is being given over to the private sector while FRED develops new cultural technology for other species, such as sockeye salmon, etc. FRED Division's Southeast projects produced 18,700 chinook salmon in 1989. Alaska hatchery chinook salmon contributions to the troll and sport fisheries in Frederick Sound are growing steadily, approaching 30% in the 1988-1989 winter troll catch and in the sport catches. Production from existing Alaskan chinook salmon enhancement programs is not expected to peak until the mid-1990s. Enhancement, in addition to much-improved escapements observed in the local wild chinook salmon stocks, indicate better days ahead.

Harvest estimates of Alaska hatchery chinook salmon indicate that state projects provided approximately 11,200 of this prized species to southeast Alaska fisheries in 1989. The commercial fleets harvested 8,260 state-produced chinook salmon in 1989. Sport fishermen throughout southeast Alaska received the benefit of an additional 2,830 hatchery-produced chinook salmon. Crystal Lake Hatchery again provided the bulk of Alaska hatchery contributions to southeast Alaska fisheries from three release sites: Crystal Creek at the hatchery, Ohmer Creek just south of the hatchery, and Earl West Cove near Wrangell. Earl West Cove is a cooperative remote-release site managed by

SSRAA with support from FRED, NSRAA, and the USFS. Early harvest estimates of Alaska hatchery chinook salmon from three release sites indicate Crystal Lake Hatchery stocks provided approximately 7,160 fish to southeast Alaska commercial fisheries in 1989. The commercial troll fleet harvested 4,420 Crystal Lake Hatchery chinook salmon, about equally distributed in the winter, test, and summer fisheries. The gillnet fisheries landed approximately 2,380 Crystal Lake Hatchery chinook salmon primarily in terminal fisheries. The seine fishery took another 360 Crystal Lake Hatchery chinook salmon. Sport anglers throughout southeast Alaska received the benefit of an additional 1,760 Crystal Lake Hatchery chinook salmon, of which an estimated 1,150 fish were landed in a special fishery downstream from the hatchery. An estimated 20% of the Petersburg marine chinook salmon harvest came from Crystal Lake Hatchery stocks in 1989. Personal-use fishermen took approximately 177 chinook salmon in a dipnet fishery in Ketchikan Creek.

In 1989 the coho salmon return to Southeast was somewhat improved over the poor 1988 return. The total production of coho salmon by state projects in 1989 is estimated at 75,380, with approximately 38,400 being harvested by the commercial fleets, 9,940 taken by sport fishermen, and 1,170 taken by personal-use fishermen. Klawock Hatchery was a major contributor of coho salmon in 1989 with a total production of almost 39,000 fish. The federal-aid Dingell-Johnson (D-J)-supported sport fish program at Snettisham had a major return of over 16,000 fish, of which 4,710 were taken by sport fishermen in the Juneau area.

Southeast Releases

Southeast FRED Division facilities released over 25.7 million fish in 1989 (See Table 2). This is a major decrease from the 1988 releases, due primarily to the contracting of Hidden Falls Hatchery in 1988. Hidden Falls Hatchery alone released over 52 million fish in 1988. A major decrease in chum salmon releases from Snettisham Hatchery also contributed to the lowered fish release in 1989. Chum salmon releases from southeast Alaska hatcheries, which have totaled between 80 and 95 million for the past several years, were slightly over 10.6 million in 1989. Major producers of chum salmon in 1989 were Snettisham Hatchery at over 6.4 million released and the Marx Creek Spawning Channel with over 4.2 million released. Sockeye salmon releases from Southeast FRED projects continue to increase dramatically. Almost 8.6 million sockeye salmon fry were released in 1989 compared to 6.7 and .25 million in 1988 and 1987, respectively. This increase in sockeye salmon releases is continuing evidence of FRED Division's commitment to its sockeye salmon initiative. This release number is expected to continue to increase rapidly as Klawock Hatchery initiates its sockeye salmon program. Increasing sockeye and chum salmon production from Snettisham and Marx Creek will slowly bring release numbers up through time. Chinook salmon releases increased by more than 20% over 1988 numbers with a release of over 2.5 million chinook salmon smolts in 1989. For the second year in a row, Crystal Lake Hatchery released over 1 million chinook salmon smolts. Snettisham Hatchery released over 1 million chinook salmon smolts (1.22 million) for the first time. Coho salmon releases across the region remained very similar in 1989, with 3.9 million released compared to 3.6 million in 1986. Klawock Hatchery is the major coho salmon producer in southeast Alaska with Snettisham, Deer Mountain, and Crystal Lake Hatcheries each having moderate levels of coho salmon production.

Southeast Egg Takes

Eggs taken by Southeast FRED projects are fewer in 1989 primarily due to lower numbers of chum salmon eggs taken at Snettisham Hatchery than had been anticipated. Slightly over 24 million eggs were taken in 1989 (See Table 3) compared to 36 million taken in 1988. The numbers of sockeye salmon eggs taken in southeast Alaska continue to increase with over 15.4 million eggs taken in 1989. Again, this growth in numbers is significant in that it demonstrates FRED Division's continuing commitment to its sockeye salmon initiative, which began in 1987. Crystal Lake Hatchery, which has been the primary source of chinook salmon eggs for itself, Snettisham, and several PNP hatcheries, took only approximately 1.8 million eggs in 1989, as compared to about 6.7 million in 1988. The hot, dry weather during the time the chinook salmon were returning to the hatchery created extremely warm water temperatures in Blind Slough with the result that over half the returning adults died. Coho salmon eggs were taken in relatively similar numbers as in 1988.

PRINCE WILLIAM SOUND

Summary of FRED Projects

The Prince William Sound Area encompasses ADF&G Commercial Fisheries Management Area E and includes the marine waters and freshwater drainages between Cape Suckling and Cape Fairfield (Figure 5). The three distinct geographic subareas present are: (1) Prince William Sound drainages and estuary, (2) the Copper River drainage and estuary, and (3) the Bering River drainage and estuary.

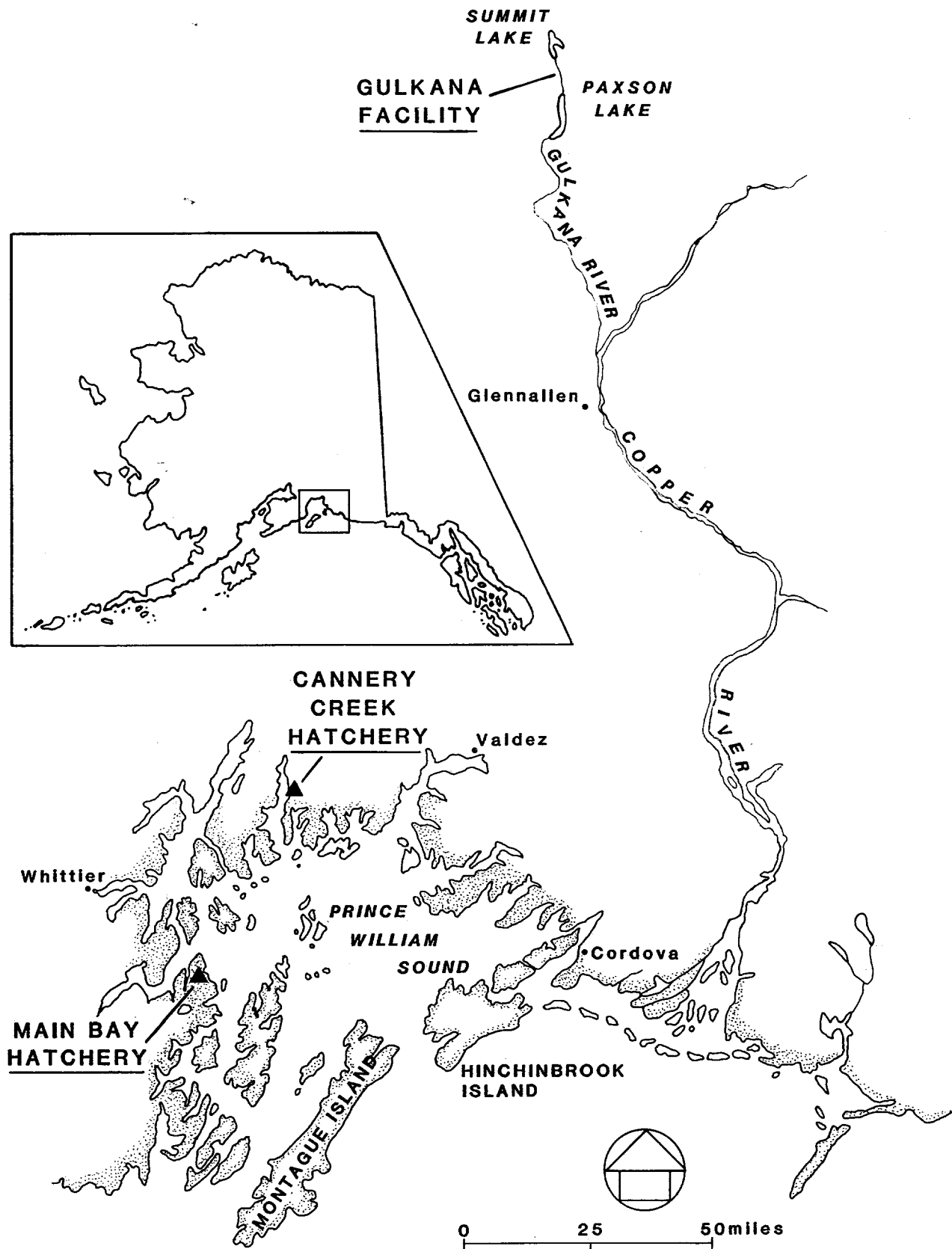
The commercial fishery includes three gear groups: purse seine, drift gill net, and set gill net. The purse-seine fishery (263 permits) is, by regulation, restricted to the following districts in Prince William Sound: Eastern, Northern, Unakwik, Coghill, Northwestern, Southwestern, Montague, and Southeastern. The bulk of the catch is pink and chum salmon. The drift gillnet fishery (536 permits) has, by regulation, been conducted in the following districts: Copper River, Bering River, Coghill, Unakwik, and Eshamy. The catch is composed mostly of sockeye, chinook, chum, and coho salmon. The set gillnet fishery (30 permits) is conducted solely in the Eshamy District. The catch is composed mainly of sockeye, pink, and chum salmon.

Substantial subsistence and personal-use fisheries occur in the Copper River where sockeye salmon are harvested along with lesser numbers of chinook and coho salmon. Some subsistence fishing does occur on the Copper River Delta and in Prince William Sound, but catches are considered negligible.

Extensive sport fisheries exist on the upper Copper River, Valdez Bay, near the town of Whittier, and in the vicinity of Cordova. The upper Copper River fishery is aimed primarily at native chinook and sockeye salmon. The Valdez Bay fishery harvests pink and coho salmon. The Passage Canal fishery is aimed primarily at hatchery-produced coho and chinook salmon. The fishery near Cordova is aimed primarily at coho and sockeye salmon.

FRED Division activities in Prince William Sound in 1989 were heavily impacted by the Exxon Valdez oil spill. During the early days of the spill, a great deal of time and effort

Figure 5. Map of Prince William Sound.



were expended by area staff responding to information requests about the Prince William Sound hatchery program and the potential effects of the oil spill on hatchery production. Area staff also participated in the impact assessment planning process for the Prince William Sound coded-wire tagging program. A large portion of the coded-wire tagging program for 1989 was implemented due to the expertise available in the FRED Division area and regional offices. The impact assessment tagging program will be expanded in 1990 under direction of the FRED Division.

Activities at the state-owned and operated hatchery at Main Bay were severely disrupted as a result of the Prince William Sound oil spill. The area around the hatchery was heavily oiled, but the inside waters of the bay were protected by oil booms. The oil booms hindered the normal flow of traffic in and out of the hatchery and were a large, disruptive influence to hatchery personnel. In addition to oil booms, hatchery personnel were required to deal with an extremely large volume of oil-associated human traffic, numerous requests for biological samples, and numerous requests to relay information to or from the massive fleet of oil spill response vessels. These and other impacts disrupted normal fish-culture activities at the hatchery and, undoubtedly, had a negative impact on hatchery production and associated research.

Main Bay Hatchery is the only hatchery in Alaska raising yearling (reared in hatchery raceways for 12 months) sockeye salmon smolts. Smolt performance in 1989 was outstanding. Sockeye salmon appear to be amenable to rearing at higher-than-anticipated densities. Smolt rearing and release experiments are being continued to determine more ways of optimizing adult production. In addition to smolt production, Main Bay Hatchery is involved in an experimental lake stocking/lake fertilization project. In 1989 this cooperative project with the USFS was continued at two barren lakes in Prince William Sound.

The Gulkana I streamside sockeye salmon incubation facility, located on the East Fork of the Gulkana River, continued to be the dominant producer of sockeye salmon fry in Alaska in 1989. Sockeye salmon fry were released at four different sites in 1989 to produce fish for commercial, subsistence, personal-use, and sport fisheries. In addition to releasing fry, limnological and/or hydroacoustic sampling of Paxson, Summit, and Crosswind Lakes continued in order to assess the biological impacts of FRED Division's enhancement efforts. Disease-history samples were collected for the FRED Fish Pathology Section in order to monitor trends in IHN virus and other pathogens found in broodstock populations. The new (1987) Gulkana II facility continues to incubate and release sockeye and chinook salmon fry to build broodstock levels for future use.

Enhancement of the sport fishery in Prince William Sound and the Copper River Basin remains a high priority for the FRED Division. A coho salmon smolt-stocking program based out of Fort Richardson Hatchery was continued in 1989 at Whittier and Cordova. Adult returns to both locations are popular with both residents and seasonal visitors. A large rainbow trout program, also based out of Fort Richardson Hatchery, was continued in 1989. This program involves stocking both catchable and fingerling rainbow trout in road-accessible lakes along the Richardson and Glenn Highways. A similar program with Arctic grayling is conducted out of Clear Hatchery. In addition to stocking emergent fry in road-accessible lakes along the Richardson and Glenn Highways, several lakes accessible from the Copper River Highway also are stocked. Finally, an attempt is being made at Harding Lake in the Interior to establish a kokanee (landlocked sockeye salmon) fishery. Fry from the Gulkana I Hatchery are being used in this experimental program.

The Prince William Sound area has the largest concentration of commercial fishery-oriented hatcheries in Alaska. This large amount of hatchery activity has required the FRED Division to maintain a high profile in Prince William Sound activities at the area, regional, and headquarters levels. Specific activities include monitoring hatchery fish sales, monitoring broodstock collection, evaluating area enhancement activities, and participating in regional planning team activities. One activity of particular importance is the involvement of the area FRED Division staff in allocation planning recently undertaken by the Prince William Sound Aquaculture Corporation (PWSAC). PWSAC has been directed by the Alaska Board of Fisheries to develop an allocation plan for all enhanced fish in Area E.

Prince William Sound Highlights

- ° The 1989 Gulkana sockeye salmon egg take of 36,400,000 established a new record for the facility and the state.
- ° Over 3,000 sockeye salmon jacks (small, mature males) resulting from the initial 1988 smolt release returned to Main Bay Hatchery. A jack return of this magnitude bodes well for future returns.
- ° Main Bay Hatchery released 3.9 million sockeye salmon smolts. This is the largest release of sockeye salmon smolts from a hatchery in world history.
- ° The 1989 Gulkana I release of 25,755,100 sockeye salmon fry is the largest release of sockeye salmon fry from a hatchery in modern Alaskan history.
- ° Sockeye salmon returns from Gulkana Hatchery contributed an estimated \$2 million to the Prince William Sound commercial fishery.
- ° Prince William Sound sport fishermen harvested an estimated 4,000 coho salmon returning from FRED Division coho salmon smolt releases.
- ° Over 208,000 Arctic grayling fry from Clear Hatchery were stocked in 12 Prince William Sound lakes to increase area sport fishing opportunities.
- ° Over 112,000 catchable and fingerling rainbow trout from Fort Richardson Hatchery were stocked in 12 Prince William Sound lakes to benefit area sport fishermen.
- ° The 1989 Gulkana II chinook salmon egg take of 60,200 eggs established a new record for the facility.
- ° In a cooperative program with the Alaska Department of Corrections, two workers were on-site at Main Bay Hatchery for most of 1989 and helped to complete several projects.
- ° In a cooperative program with PWSAC, 10 million pink salmon fry were transported to Main Bay Hatchery to enhance the Eshamy District commercial fishery. The fry were reared in net pens at Main Bay prior to their release.
- ° FRED Division assumed a lead role in the massive Prince William Sound coded-wire tagging project. This project is one of many oil spill impact assessment

projects designed to help the state and federal agencies assess damages attributable to the Exxon Valdez oil spill.

- An experimental lake stocking/lake fertilization project was continued at two Prince William Sound lakes with the stocking of 758,000 fed fry from Main Bay Hatchery. This is a cooperative project with the USFS.

Prince William Sound Returns and Fishery Contributions

An estimated 130,000 chum salmon returned to Main Bay Hatchery in 1989 (See Table 1). Only 15,000 of these were harvested in the commercial fishery. The Eshamy District, which is the primary harvest area for Main Bay chum salmon, was closed in 1989 due to oil-contaminated beaches and water. Approximately 103,000 chum salmon were harvested in the boom-protected area in front of Main Bay Hatchery under a joint sales-harvest agreement with PWSAC.

In addition to chum salmon, Main Bay Hatchery experienced its first return of sockeye salmon. Over 3,000 sockeye salmon jacks (small, 1-lb, mature males which return to spawn after only one year in the ocean) returned to the hatchery. This marks the first sockeye salmon returns from a smolt release in Alaskan history. The magnitude of the jack return indicates that these fish had an excellent marine survival and forecasts that returns of older age classes may be much greater than anticipated.

An estimated 127,000 sockeye salmon from the Gulkana Hatchery, worth approximately \$2 million, were harvested in the commercial fishery. These fish resulted from fry releases in 1984 and 1985. Carcasses from the majority of the 20,000 fish utilized for broodstock were given to area dog mushers for dog food.

Adult coho salmon returns to Cordova and Whittier were popular with area sport fishermen. An estimated 4,000 fish were harvested. Additional fish destined for Whittier were intercepted in the Coghill District commercial fishery.

Prince William Sound Releases

Over 3.9 million sockeye salmon smolts averaging over 10 g were released from Main Bay Hatchery (See Table 2). This is the largest release of sockeye salmon smolts from a hatchery in history. Two groups of fish were released at different average sizes to determine the effect of size on marine survival. In another experiment, saltwater and freshwater release strategies were tested. An additional 758,000 fed fry were stocked in two barren Prince William Sound lake systems. This is an experimental program with ongoing evaluation.

The Gulkana I Hatchery released 25,755,100 sockeye salmon fry in 1989. This is the largest release of sockeye salmon fry from a hatchery in modern Alaskan history. Over 12 million sockeye salmon fry were transported by truck to Summit Lake for release and an additional 500,000 were hauled by truck to Harding Lake. Approximately 9.6 million were released at the Gulkana I Hatchery site. A joint FRED/Bureau of Land Management effort allowed the transport of over 3.1 million sockeye salmon fry to Crosswind Lake via an "ag-truck" aerial transport. The Gulkana II Hatchery released 765,000 sockeye salmon on-site, while 16,000 chinook salmon fry were transported by aircraft to Monsoon Lake.

Over 490,000 fish were released to enhance area sport fisheries. An estimated 151,800 coho salmon smolts from Fort Richardson Hatchery were released in Whittier and Cordova. A total of 208,000 grayling fry from Clear Hatchery were stocked in 12 road-accessible area lakes. Fort Richardson Hatchery also produced 112,000 rainbow trout for release in 12 road-accessible area lakes.

Prince William Sound Egg Takes

Prince William Sound egg takes experienced mixed successes in 1989 (See Table 3). At 3.0 million eggs, Main Bay fell short of its goal of 5.4 million eggs. A smaller-than-expected escapement and a massive flood hampered the remote egg-take activities at Coghill Lake.

The egg take at Gulkana I Hatchery was a resounding success. The egg-take crew again set a new modern record for sockeye salmon eggs taken in one season: 36,400,000. This is an exceptional feat considering the special sockeye salmon egg-take procedures and special handling required to control and minimize IHNV outbreaks. Egg takes for sockeye and chinook salmon were conducted for the third season at Gulkana II Hatchery with 1,016,000 and 60,000 eggs, respectively, taken. The sockeye salmon egg take essentially equaled the previous high egg take, and the chinook salmon egg take more than doubled the previous high.

Sufficient coho salmon, rainbow trout, and grayling eggs were obtained for Fort Richardson and Clear Hatcheries to maintain all existing sport fish enhancement programs at present levels.

COOK INLET

Summary of FRED Projects

The drainages of Cook Inlet comprise only a small portion of the State of Alaska; however, this area includes one-half of the state's population. Consequently, numerous FRED Division projects are located in this area, which include six FRED Division facilities (Figure 6). Big Lake Hatchery in the Susitna Valley produces coho and sockeye salmon, and Elmendorf and Fort Richardson Hatcheries produce fish for sport fisheries enhancement projects. The Broodstock Development Center (BDC) provides rainbow trout eggs for the statewide stocking program. Crooked Creek Hatchery primarily produces sockeye salmon for commercial fisheries and chinook and coho salmon and steelhead trout for area sport fisheries. The Tutka Bay Hatchery, on the south end of the Kenai Peninsula, produces pink salmon that are harvested by both commercial and sport fishermen. Area biologists, located at Big Lake, Soldotna, and Homer, provide technical support for these projects and maintain coordination with biologists from the fisheries management divisions.

Big Lake Hatchery was built in 1976 as a 16 million-egg sockeye salmon incubation facility to supplement poor adult returns in upper Cook Inlet. The facility has since expanded its production to include short-term-reared sockeye salmon, and coho salmon fingerlings, presmolts, and smolts. In 1989, however, Big Lake Hatchery production suffered due to an unexpected water-quality problem. A bloom of iron bacteria in the

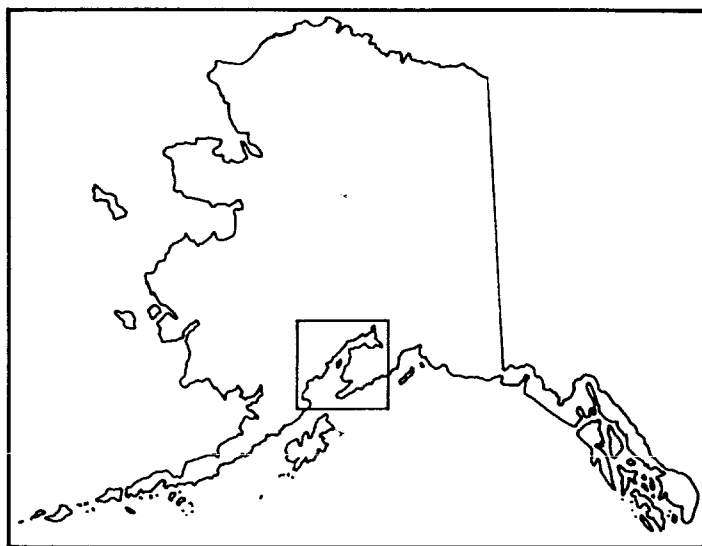
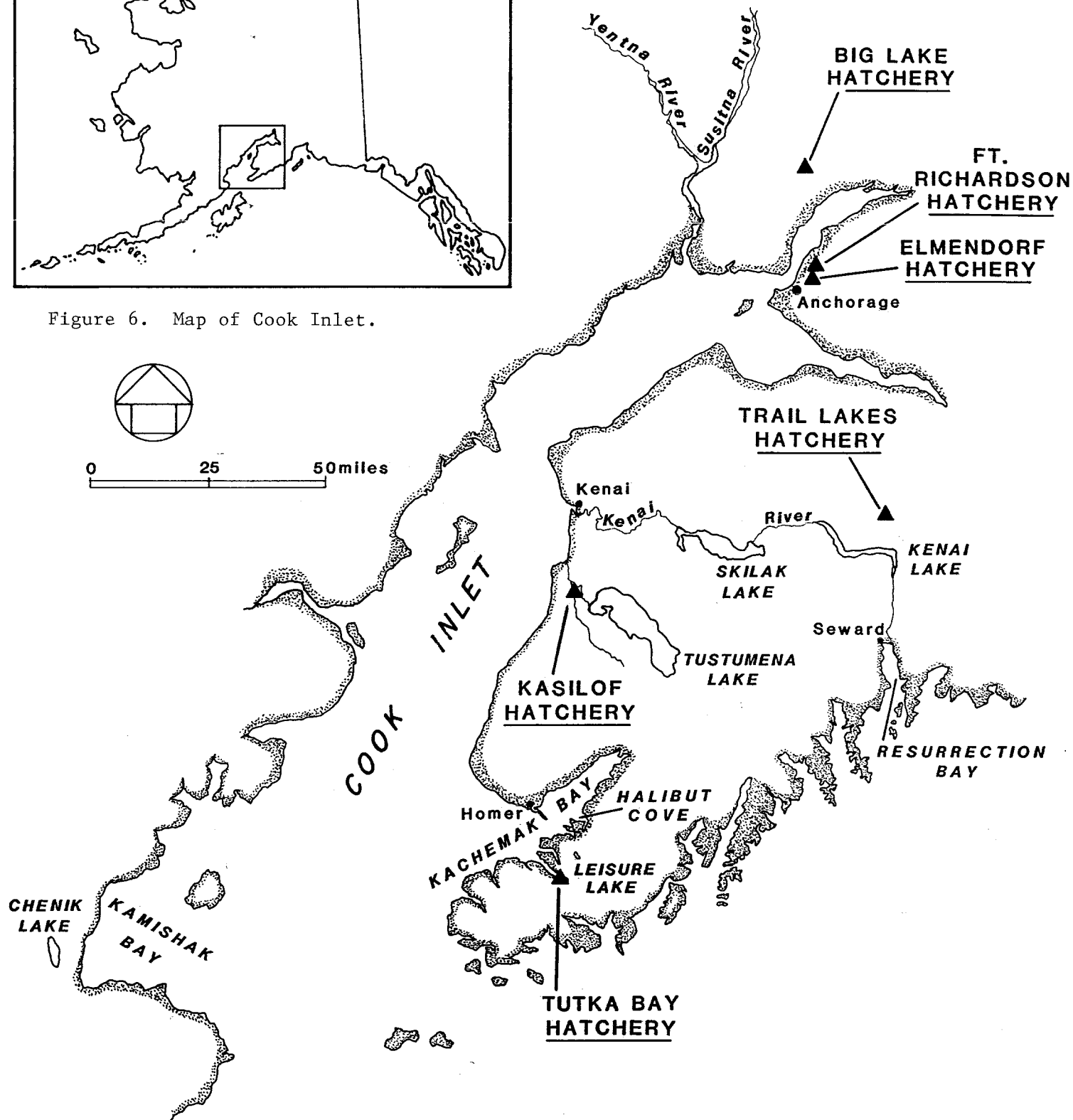


Figure 6. Map of Cook Inlet.



groundwater supply fouled incubators causing a partial loss of sockeye salmon and close to a total loss in coho salmon. A major effort was put forth to clean the entire system, including the disinfection of all pipes and well fields. Some fish-culture refinements are being implemented to reduce potential loss if the water-quality problem continues. Water sampling was conducted to determine if there is a solution to this problem. Coho and sockeye salmon smolt operational processes continue to be tested and refined. Production numbers and release strategies are being refined for best survivals and cost-effectiveness. Differential marking of fingerlings, presmolts, and smolts are providing valuable information for the best production strategies and the future direction of the facility. Sockeye salmon research also remains a priority at Big Lake Hatchery.

The primary goal of the Elmendorf State Hatchery is to produce chinook and coho salmon to enhance sport fishing opportunities at sites throughout southcentral Alaska and Kodiak Island. The hatchery is located two miles north of downtown Anchorage, next to the power plant on the Elmendorf Air Force Base. Through an agreement with the U.S. Air Force, the hatchery uses the excess heated-water effluent from the power plant to accelerate growth and development of some fish stocks. The hatchery produces accelerated-growth age-0.0 chinook salmon smolts, age-1.0 coho salmon smolts, and coho salmon fingerlings. Also, for the first time this year, the hatchery produced an experimental lot of age-0.0 coho salmon smolts. Elmendorf Hatchery is a centralized incubation and rearing facility. Its programs serve Kachemak Bay, Resurrection Bay, central Cook Inlet, the Matanuska Valley, Anchorage, and Kodiak.

The objective of the BDC is to maintain and develop broodstock for rainbow trout enhancement programs in southcentral and interior Alaska. In addition, the BDC also was designed as a small research facility to solve problems encountered in the production of rainbow trout and other species. To accomplish these goals, the BDC was established as a part of the Fort Richardson Hatchery. The physical structures include the BDC building, nine outdoor raceways, and a spawning shed. The BDC building houses a "wet laboratory" for incubation and rearing and a "dry laboratory" for water-quality analyses and basic fish-health inspections. The water supply and other support facilities are provided by the Fort Richardson Hatchery. In addition to the three primary projects (broodstock maintenance, random-lot spawning, and broodstock selection) which satisfy the main objective of the BDC, several other research projects were supported by the BDC staff during the past year.

Presently, three rainbow trout broodstocks are maintained at the BDC: Swanson River, Big Lake, and Swanson River Select. The goal of this project is to maintain enough broodstock from these strains to meet the requirements of rainbow trout sport fishery enhancement programs for southcentral and interior Alaska. No major problems were encountered this year in maintaining the three strains of broodstock. Random matings within these stocks produced all the eggs needed for southcentral and interior Alaska rainbow trout sport fisheries enhancement programs.

The goal of the random-lot spawning project at the BDC is to operate the annual rainbow trout egg take and collect enough eggs for southcentral and interior Alaska rainbow trout sport fisheries enhancement programs and replacement broodstock. A total of 6.1 million eggs were taken during spring 1989 from the Swanson River Select, Swanson River, and Big Lake broodstocks. These eggs were the result of random matings within each strain. Post-spawning mortality was extremely high this year, but enough fish are available to meet 1990 planned egg production.

The goal of the broodstock selection project at the BDC is to develop a strain of rainbow trout that has high survival and fast growth in both hatchery and wild environments. Eventually, this strain is expected to be selected as the choice domestic broodstock for rainbow trout hatcheries in southcentral Alaska. This project follows a long-term genetic-selection program based on individual and family selection. On 4 April 1989, eggs and sperm were taken from randomly selected parents to form the 64 individual families from which 16 families were ultimately selected.

Although the primary goal of the BDC is to produce eggs for the rainbow trout enhancement program, results from several projects contribute significantly to enhancement programs statewide. The need to develop a standardized hatchery management program (rearing model) to optimize use of computers located in hatcheries has been identified as a high priority, and funding was made available to begin development of the Computerized Hatchery Management Program, "CHAMP." The rainbow trout diet comparison for broodstock project was conducted with a comparison of OMP and Moore Clark's brood diet during FY 89. The project to develop all-female rainbow trout is proceeding. Eggs were fertilized with irradiated sperm and heat-shocked. After emergence, the fry were fed testosterone. Of three treatment levels, two were successful in producing a sex reversal. In addition, the project to produce triploid rainbow trout was repeated and several of the treatment groups had 100% incidence of triploidy, creating a sterile population of male trout.

The Fort Richardson Hatchery is a state facility operated by the FRED Division. It is located on the Fort Richardson Military Reservation near Anchorage. This complex CIF is designed and operated for the production of rainbow trout and chinook and coho salmon for stocking in numerous streams, lakes, and marine waters to create or enhance sport fisheries. The hatchery's most important program is production of rainbow trout.

Renovation of the hatchery was completed in January 1984. It is designed to use only well water for fish production and heat is extracted from the U.S. Army's Central Heat and Power Plant effluent to warm the well water and accelerate fish growth. Current maximum production, limited by the availability of well water, is approximately 5 million fish or 55,000 kg, yearly. Typically, this will include: 2.0 to 2.5 million rainbow trout fingerlings, 230,000 catchable-sized rainbow trout, 800,000 chinook salmon smolts, and 600,000 coho salmon smolts.

All rainbow trout and coho and chinook salmon produced at Fort Richardson Hatchery are targeted for sport fisheries. The fish are released throughout interior and southcentral Alaska. Over 300 lakes, streams, and estuaries receive fish from Fort Richardson Hatchery annually, with approximately 20,000 miles of transport-related travel. Rainbow trout production at Fort Richardson Hatchery has three components: (1) eyed eggs are transferred to Clear Hatchery; (2) fingerlings are released throughout southcentral and interior Alaska; and (3) catchable-sized fish are released in Anchorage Bowl, Matanuska-Susitna, and Fairbanks area lakes. Coho salmon smolts are released into three upper Cook Inlet streams, at Fleming Spit near Cordova, and at Whittier. Fingerlings that are surplus to the smolt project needs are released in Matanuska-Susitna Valley lakes. Chinook salmon smolts are released into three upper Cook Inlet streams and into the Ninilchik River on the Kenai Peninsula.

By early August 1989, over 1.3 million 1-g rainbow trout fingerlings had been released from Fort Richardson Hatchery into Southcentral and Interior lakes. A total of 286,000 catchable-sized rainbow trout were released during the summer of 1989. A total of 5.6 million fertilized eggs from two broodstocks were received from the BDC between

25 March and 21 April 1989. After they reached the eyed stage, 660,000 eggs were transferred to Clear Hatchery. Emergence was complete by mid-June and 750,000 Big Lake and 3.0 million Swanson River fry were ponded, and 1,200,000 fry were released shortly after emergence. By the end of July, 538,000 and 2.7 million fingerlings, respectively, from the two sources had been released. A total of 377,000 fingerlings was held for next year's catchables, subcatchables, and replacement broodstock.

Approximately 359,000 coho salmon smolts from Little Susitna River, 162,000 from Caswell Creek, and 152,000 from Fleming Spit (Cordova) were released from Fort Richardson Hatchery as full-term smolts in May and June 1989 into Nancy Lake, Caswell Creek, Whittier, and Fleming Spit. Of these, a total of 76,300 coho salmon smolts was coded-wire-tagged. As of 30 June 1989, 310,000, 155,000, and 155,000 coho salmon fingerlings from Little Susitna River, Caswell Creek, and Fleming Spit, respectively, were being reared at Fort Richardson Hatchery for release as full-term smolts in 1990.

During July 1988, 800,000 chinook salmon eggs were taken from Willow Creek and 245,000 were taken from the Ninilchik River, and a total of 680,000 Willow Creek and 200,000 Ninilchik River chinook salmon smolts were released in 1989. A total of 80,930 chinook salmon smolts was coded-wire-tagged.

The FRED Division central Cook Inlet area office is located on the Kenai Peninsula in Soldotna. Projects in the central Cook Inlet area include those bound by the area north of Ninilchik, south of Turnagain Arm, east of the Chigmit Mountains, and west of Prince William Sound. Two hatcheries are located in this area. One located near Kasilof (Crooked Creek Hatchery) is operated by the state, and the other near Moose Pass (Trail Lakes Hatchery) is operated by the Cook Inlet Aquaculture Association (CIAA) under a state contract.

The Crooked Creek Hatchery has an egg capacity of approximately 20 million sockeye salmon eggs and produces sockeye salmon fingerlings for stocking programs at Tustumena Lake and eight lakes in lower Cook Inlet. In 1989 the Crooked Creek Hatchery expanded production by assuming a portion of the coho salmon sport fish enhancement program that was previously accomplished at the Trail Lakes Hatchery. Utilizing an innovative moist-air incubation procedure, approximately 80,000 age-0.1 coho salmon smolts will be produced. In addition, a new building over the outside raceways was completed at the Crooked Creek Hatchery in 1989 for rearing up to 300,000 chinook salmon to the smolt stage. Finally, Crooked Creek Hatchery produces steelhead trout smolts for release in the Crooked and Six-Mile Creeks drainages.

The Tutka Bay Hatchery, constructed in 1976, is a remote hatchery located near the southwest tip of the Kenai Peninsula in southcentral Alaska, approximately 15 air miles across Kachemak Bay from Homer. It consists of a one-story structure that includes a pink and chum salmon incubation area, a sockeye salmon module, an office, a laboratory, a shop, and an emergency generator room. There are two single-family dwellings and a bunkhouse for the hatchery's permanent full-time fish culturist and seasonal employees. The egg-take and short-term-rearing complex is located in Tutka Lagoon, approximately three-quarters of a mile distance from the hatchery. The hatchery is capable of incubating up to 50 million eggs and rearing up to 25 million pink and chum salmon. Sockeye salmon were introduced in 1989, and future plans call to increase production at this facility upward of 5 million or more. The primary user group is commercial fishermen, which includes approximately 77 seiners and 34 set netters

manned by over 200 individuals. Sport fishing in Tutka Lagoon annually continues to draw many boats with over 2,000 anglers participating.

The commercial harvest of 628,000 pink salmon from Tutka Bay and Tutka Lagoon, combined with the 249,000 harvested from the Halibut Cove Lagoon remote rearing and release project accounted for 89% of the Southern District and 68% of the entire lower Cook Inlet commercial harvest. Ex-vessel value from these two projects was estimated at over \$925,000. Tutka Bay Hatchery's contribution to sport fishermen also was significant this year with 10,000 pink salmon estimated to have been harvested by anglers. Over 64,500 pink salmon have been harvested by sport anglers in Tutka Lagoon since 1978. Sport fishermen also harvested 10,000 pink salmon returning to the Homer Spit from the rearing and release of Tutka Bay Hatchery fry there.

The chinook salmon smolt-release project at Halibut Cove Lagoon has involved release of over 1.4 million chinook salmon smolts since 1974 with the objective of increasing sport fishing opportunities in the Kachemak Bay area. This is the oldest and one of the most popular sport fishing enhancement projects in lower Cook Inlet. Over 3,020 chinook salmon returned to Halibut Cove Lagoon in 1989, representing the fourth largest return to that site.

Six million pink salmon fry were transported from Tutka Bay Hatchery to Halibut Cove Lagoon. This was a cooperative program with the Cook Inlet Seiners' Association (CISA), the City of Homer, CIAA, and ADF&G to release pink salmon fry into new, unexploited nursery areas and to disperse the commercial fishery. The pink salmon fry were fed for 30 days before release and their size was nearly doubled. This strategy appears to be working very well, because the return in 1989 from last year's release of 3 million fry was estimated at 250,000 fish, representing an 8.3% survival rate. In addition, previous tagging studies have shown that up to 15% of the fry may have imprinted and returned to Tutka Creek.

The Kamishak Bay chum salmon project was established in 1986 to further enhance the fishery in lower Cook Inlet by introducing late-run chum salmon to Tutka Bay. Approximately 2.6 million chum salmon eggs were taken in 1988 using a donor stock from the Kamishak Bay area of Cook Inlet. This year approximately 2.1 million eggs were collected for incubation and release into Tutka Bay. Returns to the Tutka area are anticipated in the fall of 1990.

Returns from releases of juvenile chinook, coho, and pink salmon on Homer Spit create fishing from late May through September where none previously existed. Chinook salmon smolts have been released on the Homer Spit since 1984. Pink salmon fry have been released since 1987 in a cooperative project between the FRED Division's Tutka Bay Hatchery, the City of Homer, the South Peninsula Sportsman's Association (SPSA), and CISA. Coho salmon smolt releases were initiated in 1988. In addition, approximately 10,000 pink salmon returned to the Homer Spit from a 1988 release.

Cook Inlet Highlights

- ° In 1989 FRED Division projects accounted for over 67% (nearly 1 million fish) of the \$2.6 million ex-vessel value of the lower Cook Inlet salmon harvest (1,480,000 fish).

- ° The Chenik and Leisure Lakes stocking projects have provided over 73% (119,000 fish, including a 38,900 cost-recovery harvest from Chenik Lake) of the total lower Cook Inlet sockeye salmon harvest in 1989. Ex-vessel value from these two projects was estimated at \$800,000.
- ° In 1989 pink salmon returns to Tutka Bay Hatchery and Halibut Cove Lagoon accounted for 68% of the entire lower Cook Inlet pink salmon harvest (1,300,000 fish). The value of the harvest from these projects was nearly \$1 million.
- ° Tutka Bay Hatchery had the second-highest return from its fry releases in the facility's 13-year history at 961,000 pink salmon. This represents an overall ocean survival of 6.3%—the highest since 1982.
- ° Over 48 million salmon fry, fingerlings, and smolts were released in the lower Cook Inlet area in 1989 to provide future contribution to area fisheries. Returns could exceed 1 million salmon.
- ° Over 39,000 salmon were harvested by sport fishermen in 1989 from various enhancement projects in the Kachemak Bay area.
- ° The salmon-stocking program on the Homer Spit has created an extremely popular, family-oriented fishery; in 1989 an estimated 3,000 chinook, 10,000 pink, and 2,500 coho salmon were harvested by anglers.
- ° The Homer FRED and Sport Fish Divisions received a commendation for Meritorious Service for sport fisheries enhancement from the City of Homer and SPSA.
- ° The Halibut Cove Lagoon project had a return of 249,000 pink salmon in 1989; this represents an 8.3% ocean-survival rate.
- ° The harvest goal for the Tutka Bay Hatchery project, as set forth in the Cook Inlet Regional Salmon Enhancement Plan, was an annual harvest of 560,000 pink salmon by the year 1990. The hatchery has exceeded this goal in 1981, 1983, 1988, and 1989.
- ° A production-scale sockeye salmon feeding trial was held at Big Lake Hatchery. Sockeye salmon fry were fed OMP mash, OMP select, and Biodiet. Growth rates were compared, a sockeye salmon adult holding/ripening experiment was performed, and a long-term, full-length coded-wire tag retention study was completed on coho salmon smolts.
- ° Students from local high school classes participated in a coho salmon egg take at Big Lake Hatchery. Four classroom incubators were installed at local schools.
- ° An estimated 264,000 hatchery-produced sockeye salmon returned in 1989 from the Tustumena Lake sockeye salmon enhancement project. This represents a hatchery-contribution rate of 33% for the total return.
- ° An estimated total harvest of 9,373 Crooked Creek chinook salmon were sport-caught in 1989. This is second only to last year's record catch and exceeded the 1989 early-run Kenai River chinook salmon sport harvest by 2,000. The total return to Crooked Creek was 13,346 chinook salmon, of which 66% were hatchery-produced.

- ° The total contribution of hatchery-produced (combined PNP and state facilities) coho salmon caught in the Resurrection Bay shore and boat sport fisheries in 1989 was 37%, or 6,520 of the 17,416 coho salmon sport-harvested. In addition, a total of 826 hatchery-produced chinook salmon was caught by anglers in Resurrection Bay.
- ° The total return of coho salmon to Crooked Creek was 8,300, of which 55% (4,570) were hatchery-produced. An estimated 2,000 coho salmon were caught in the sport fishery, of which 1,100 were hatchery-produced.
- ° An estimated sport catch of 60 steelhead trout in Crooked Creek represents returns from smolts released from Crooked Creek Hatchery and the beginning of a significant sport fishery for steelhead trout on the Kenai Peninsula.
- ° In 1989 a donation-collection program was implemented at Crooked Creek Hatchery for visitors. Although this program was initiated late in the year, a total of \$300 was collected.
- ° Dr. Victor Bugaev, a Soviet fisheries biologist, visited the Soldotna area office of ADF&G for two days in August to discuss sockeye salmon biology and research. Dr. Bugaev is involved in sockeye salmon stock-segregation research and was interested in all aspects of the division's enhancement and evaluation work. He particularly was interested in hydroacoustics and accompanied ADF&G personnel during the Tustumena Lake hydroacoustic survey.
- ° An estimated 90% of the 14,000 coho salmon sport-harvested from the Little Susitna River were of hatchery origin. The estimated smolt-to-adult survival rate for hatchery-produced coho salmon in the Little Susitna River ranged between 7% and 9%.
- ° A detailed program/project review for northern Cook Inlet was held by FRED Division staff. The FRED, Sport Fish, and Commercial Fisheries Divisions considered results from evaluation work and opted for coho salmon operations at Big Lake Hatchery to become focused on coho salmon smolt production; eliminated were the fingerling and presmolt programs. The ultimate goal is to liberalize weekend-only regulations for Knik Arm tributaries.
- ° An estimated 37% of the 2,500 chinook salmon sport-harvested at Willow Creek were of hatchery origin. Because of the hatchery contribution, fishing time regulations have been liberalized from 12 to 22 days per season.
- ° An estimated 90% of the approximately 1,000,000 sockeye salmon smolts emigrating from the Big Lake drainage are hatchery-produced from Big Lake Hatchery. Preliminary information indicates a 5%-7% stocked fingerling-to-smolt survival and a smolt-to-adult survival rate of 35%.
- ° A terminal commercial fishery was opened by emergency order to harvest surplus sockeye salmon bound for Big Lake. Approximately 40,000 sockeye salmon were caught.
- ° A personal-use fishery was opened by emergency order to harvest surplus sockeye salmon bound for Big Lake. Approximately 8,000 sockeye salmon were caught.

- ° Over 800,000 chinook salmon, 6.8 million coho salmon, and 19.7 million sockeye salmon eggs were taken for northern Cook Inlet enhancement projects.
- ° Chinook salmon smolts were transported from Elmendorf Hatchery (via Sealand container ship) to Kodiak Island and released to initiate a new sport fishery in Kodiak.
- ° An experimental group of accelerated-growth, age-0.0 coho salmon smolts were released from Elmendorf Hatchery. These fish performed well in the hatchery and responded well in the seawater-challenge tests, but final determination of success will depend upon adult returns.
- ° A total of 60,000 visitors came to Elmendorf Hatchery in 1989; most wanted to view the returning Ship Creek chinook salmon.
- ° In 1989 an estimated 11,000 adult chinook and 7,640 adult coho salmon were harvested by Southcentral sport fishermen from Elmendorf Hatchery releases. In addition, salmon have been stocked into landlocked lakes to create additional roadside fishing opportunities.
- ° Approximately 6.1 million rainbow trout eggs were taken at the BDC in April 1989, exceeding the original goal by more than 20%.
- ° The second year of the all-female project at the BDC was successful when the sex of rainbow trout was reversed; genotypic females were turned into phenotypic males.
- ° The second year of the triploidy project at the BDC was successful when several treatment groups were found to be 100% triploid, creating a sterile population of male trout with a chromosome type of XXY.
- ° Production at Fort Richardson Hatchery in 1989 was over 5.6 million fish and eggs. This is a new facility record and an increase of over 5,000 kg from last year.
- ° Fort Richardson Hatchery released 3.21 million rainbow trout fingerlings. The hatchery was able to meet all requests.
- ° Over 283,000 catchable-sized rainbow trout were released from Fort Richardson Hatchery, setting a new season record.
- ° An estimated 37% of the chinook salmon harvested at Willow Creek in 1989 were of hatchery origin.
- ° Over 73,000 angler-days were generated by Fort Richardson Hatchery's rainbow trout projects in the Anchorage area.
- ° Over 18,000 angler-days were spent fishing for hatchery-produced rainbow trout in the Kepler Lakes complex near Palmer.

Cook Inlet Returns and Fishery Contributions

Adult salmon returns to the lower Cook Inlet area demonstrate wide fluctuations, often a result of flooding or ice scouring in the spawning streams and rivers. It is apparent that salmon produced by FRED projects make a significant contribution to local commercial and sport fishing harvests. This contribution has ranged from 25%-90% and is expected to remain high in future years. It is hoped that areas impacted by oil from the Exxon Valdez spill will be cleaned and commercial fishing will reopen in 1990.

Over 15,500 salmon returned to the Homer Spit sport fish enhancement project in 1989 (See Table 1). Sport fishermen harvested 3,000 chinook salmon from late May through early July, 10,000 pink salmon during July through early August, and 2,500 coho salmon in August and September.

The Tutka Bay Hatchery had its second-highest return to the facility in its 13-year history. The total accountability from hatchery production was 961,000 fish. Tutka Bay Hatchery production accounted for 68% of the entire 1989 lower Cook Inlet commercial pink salmon harvest. The ex-vessel value was over \$952,000. Of the commercial catch of 878,117 fish, 250,000 were from a pink salmon rearing project at Halibut Cove Lagoon utilizing Tutka Bay Hatchery fry. This was a joint cooperative project between the FRED Division and CISA.

Tutka Bay Hatchery's contribution to the lower Cook Inlet salmon fleet has been significant over the life of the facility with production up to 91% of the entire commercial harvest for pink salmon in lower Cook Inlet. This is the second consecutive year that Tutka Bay Hatchery produced over 900,000 returning pink salmon.

The number of hatchery-produced sockeye salmon returning from the stocking program in Tustumena Lake totaled 264,000 adults. The number of hatchery-produced sockeye salmon caught in the commercial fishery was 208,000. At an average value of \$1.70 per pound for sockeye salmon in Cook Inlet during the 1989 commercial fishery, the ex-vessel value of hatchery-produced sockeye salmon in central Cook Inlet during 1989 totaled nearly \$1.8 million.

Shore anglers spent nearly 27,000 angler-days harvesting 8,428 chinook salmon in the Kasilof River sport fishery in 1989. In addition, a total of 945 chinook salmon were reported caught by clients of sport fishing guides operating on the Kasilof River. The total sport harvest in 1989 of 9,373 was second only to last year's record catch of 11,200 and consisted of 2,000 more chinook salmon than the 1989 harvest in the early-run of the Kenai River. Since 1984 the annual sport harvest of chinook salmon in the Kasilof River has exceeded that for the early-run chinook salmon of the Kenai River during three years.

Sport fisheries enhancement projects in northern Cook Inlet, developed with the ADF&G, Sport Fish Division, continue to demonstrate their benefits. The Willow Creek chinook salmon fishery, once a four-weekend, two-day-only fishery (i.e., 8 of 30 days), has been liberalized to include 22 of 30 days that are now open to fishing. In 1989 approximately 37% of the fish caught at Willow Creek were from hatchery production. Also, chinook salmon from first releases in 1988 at Sheep and Montana Creeks already have begun to contribute to the creel, as evidenced by recovery of marked fish at those locations. At Little Susitna River, approximately 90% of the 14,000+ coho salmon caught were from hatchery releases. Coho and sockeye salmon

runs in the Big Lake drainage are comprised of approximately 90% hatchery contribution.

Cook Inlet Releases

A total of 48.9 million juvenile salmon representing all five species of Pacific salmon was released in lower Cook Inlet waters in 1989, setting a record for this area. Over 39,000 salmon were harvested by sport fishermen from various enhancement projects in the Kachemak Bay area in 1989.

Approximately 200,000 chinook salmon smolts were released at the Homer Spit. A total of over 153,000 coho salmon smolts, representing two diet-trial groups, was released. Over 330,000 pink salmon fry from Tutka Bay Hatchery were held and fed in the Homer Spit Lagoon for 24 days prior to being released outside the lagoon in order to minimize predation by smolts previously released in the lagoon. In addition, the City of Homer reaffirmed its commitment to the Homer Spit sport fish enhancement program by designating the area around the spit lagoon as a City Park Recreational Area.

Approximately 600,000 hatchery smolts were produced from the 3.0 million sockeye salmon fry released in Packers Lake in 1988 from the Trail Lakes Hatchery. This project is a joint enhancement project between CIAA and ADF&G. Packers Lake has undergone nutrient enrichment since 1983 and last year was the first year it was stocked with sockeye salmon fry.

A number of remote lakes again were stocked in lower Cook Inlet. A total of 3.7 million sockeye salmon fry from Crooked Creek Hatchery was stocked by aerial application into six different lakes in 1989 after three years of prestocking limnological investigations.

Approximately 22 million pink salmon were reared and released from Tutka Bay Hatchery in 1989. This is an increase of approximately 11 million over 1988. Approximately 2.1 million Kamishak Bay chum salmon also were released into Tutka Bay. In addition, 6.2 million pink salmon were transported to Halibut Cove Lagoon for rearing and release. This represents an increase of 3.2 million fry over 1988. Another lot of 300,000 pink salmon fry were transported to the Homer Spit for rearing and release for a sport fish enhancement project, and approximately 300,000 pink salmon fry also were transported to Ingram Creek (Portage area) for development of a sport fishery.

In 1989 a total of 1,314,000 age-0.0 chinook salmon smolts, 335,000 age-1.0 coho salmon smolts, and 93,000 age-0.0 coho salmon smolts were produced and released from Elmen-dorf Hatchery into anadromous waters in southcentral Alaska. In addition, 191,000 chinook and coho salmon fingerlings were released into landlocked lakes in the Matanuska Valley.

Cook Inlet Egg Takes

The English Bay Lakes system has the only significant natural run of sockeye salmon in the Southern District of the lower Cook Inlet area. This project was initiated in 1989 to reverse declining trends in the English Bay sockeye salmon escapements and harvests in the English Bay Lakes system. This year's experimental egg take yielded a total of

427,000 eggs collected for incubation (See Table 3) and release of fry into the English Bay Lakes system in the spring of 1990.

A total of 17.5 million sockeye salmon eggs was taken for Crooked Creek Hatchery from the stock at Tustumena Lake for sockeye salmon enhancement projects in lower Cook Inlet, as well as at Tustumena Lake. Chinook salmon eggs taken by staff of this facility include 1.3 million eggs from the Crooked Creek broodstock, which were transferred to the Elmendorf Hatchery for accelerated-growth smolt production, 275,000 from the Ninilchik River, which were transferred to the Fort Richardson Hatchery for accelerated-growth smolt production, and 400,000 from the Kasilof River broodstock. The 400,000 chinook salmon eggs from the Kasilof River will be incubated and reared to age-1.0 smolts at the Crooked Creek Hatchery. Finally, 580,000 coho salmon eggs and 130,000 steelhead trout eggs were taken from Crooked Creek for incubation and rearing at the Crooked Creek Hatchery.

Approximately 6.1 million rainbow trout eggs were taken from Swanson River Select, Swanson River, and Big Lake strain broodstocks during 13 days of egg takes at the BDC.

KODIAK AND ALASKA PENINSULA

Summary of FRED Projects

The FRED Division Kodiak area office is located in the City of Kodiak. The area covers the Kodiak Island Archipelago (Figure 7) and the southern and eastern slopes of the Alaska Peninsula from Cape Douglas to the southern entrance of Imuya Bay (Figure 8). The office also supports the Russell Creek Hatchery in Cold Bay.

Within the past 20 years salmon production has increased from the 100-year average of 6.3 million to 9.2 million. The even-year average is 11.6 million; the odd-year average is 6.8 million. Species composition has averaged 85% pink salmon, 7% sockeye salmon, 8% chum salmon, 1% coho salmon, and <1% chinook salmon, annually. The Kodiak salmon production has averaged 18.6% of the annual production for Alaska from 1962-1981.

The FRED Division operates projects and facilities that contribute salmon to the annual production of the Kodiak area. Projects such as the Karluk and Frazer Lake fertilization projects rehabilitate areas that were historically productive; others, such as the Kitoi Bay Hatchery, enhance natural production. The salmon produced by FRED Division benefit commercial, sport, personal-use, and subsistence fisheries. In addition, in 1989 mariculture feasibility studies were continued in the Kodiak area. Four active scallop- and mussel-culture activities are coordinated through the Kodiak area office of the FRED Division.

Lake fertilization at Frazer and Karluk Lakes were continued as important steps in rehabilitating these significant runs of sockeye salmon. As with other programs in the Kodiak area, this is a cooperative venture with the Kodiak Regional Aquaculture Association (KRAA) handling the contract and FRED Division evaluating results of the effort. Lake fertilization is becoming a key concern, with escapements exceeding the desired level at Frazer Lake and at the optimal level at Karluk Lake.

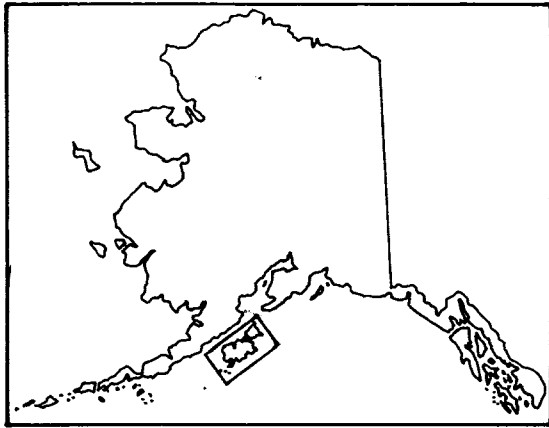
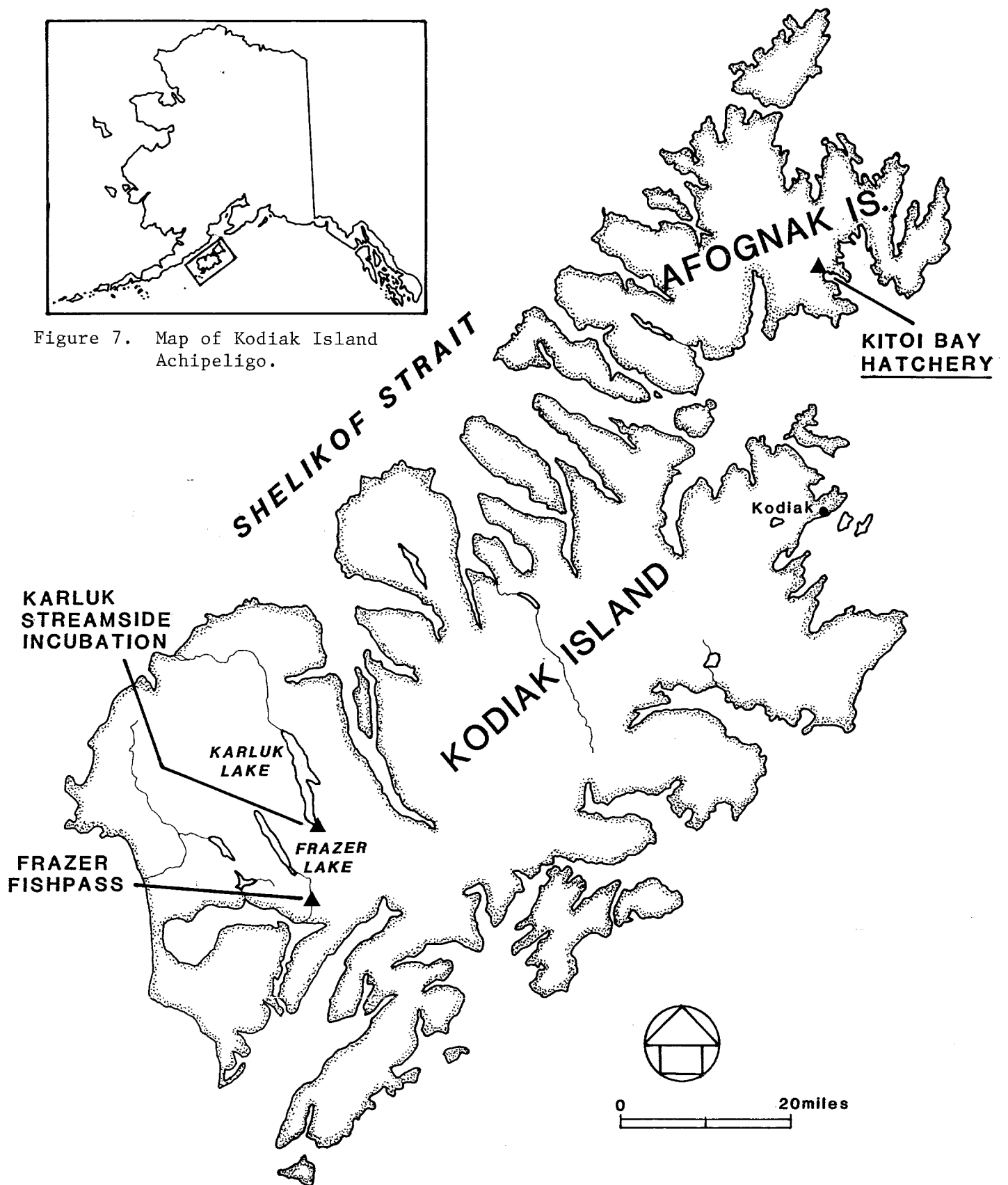


Figure 7. Map of Kodiak Island
Achipeligo.



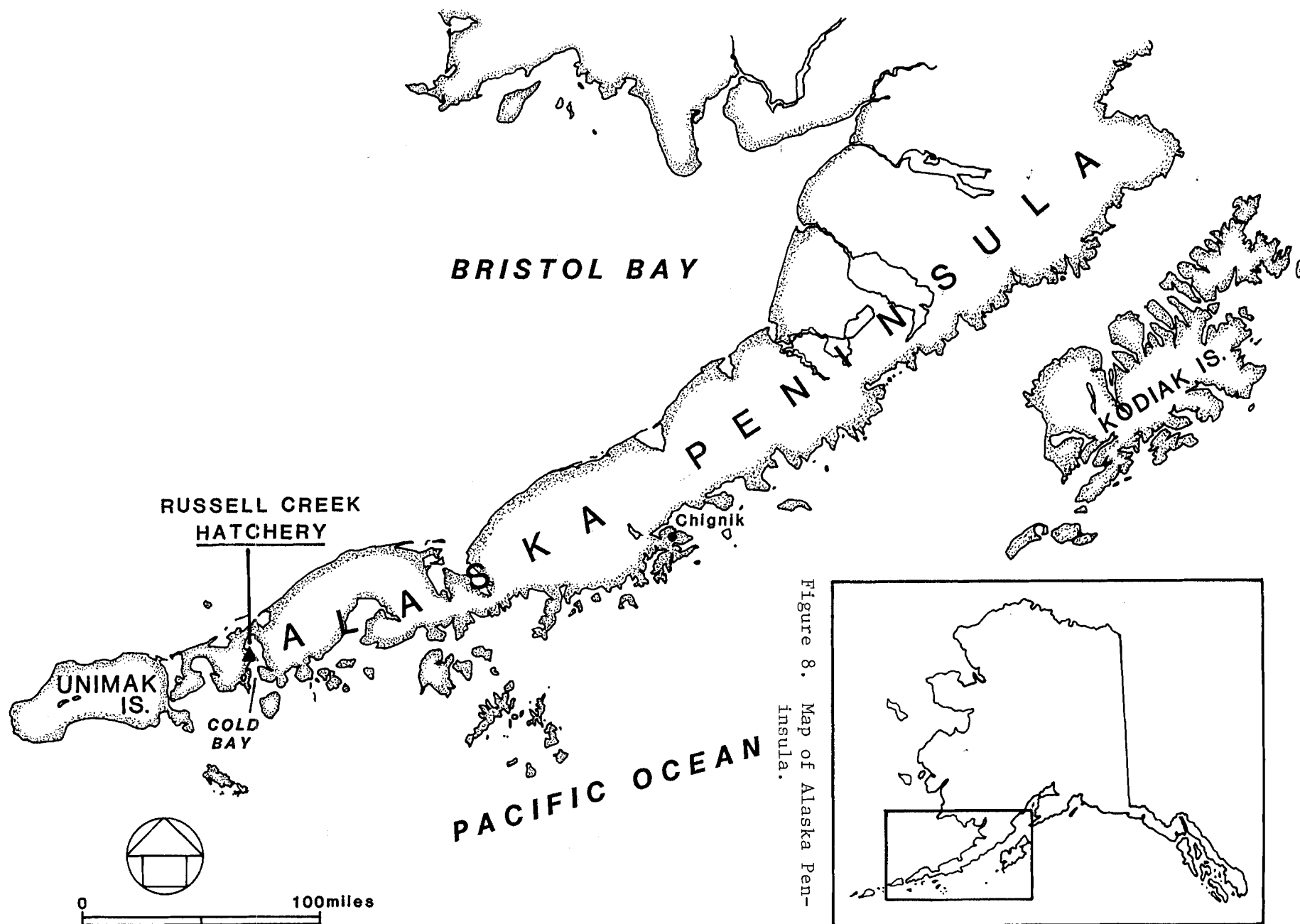


Figure 8. Map of Alaska Peninsula.

The Russell Creek Hatchery is located at the tip of the Alaska Peninsula about three miles southeast of the town of Cold Bay and about 1.5 miles upstream from salt water on Russell Creek. Constructed in 1977-1978, it has the potential to be one of the largest hatcheries in the world, with a physical capacity of 250 million pink salmon eggs when additional water sources are developed. Recent construction by hatchery staff corrected several severe design problems and added hatchery components, including a large complex of aluminum raceways for broodstock collection and spawning. The result is a very large, modern hatchery which will, at full operation, tremendously enhance the local commercial, subsistence, and sport fisheries.

The original plan for the hatchery was to produce chum salmon, and the hatchery spent several years successfully developing a large broodstock from which the hatchery could be filled to capacity. However, external concerns associated with the False Pass June fishery resulted in a decision to not pursue the culture of chum salmon at this facility in 1988 but, rather, to concentrate on pink and sockeye salmon. Further discussions at public hearings with local residents, government agencies, and fisheries groups this last year led to the reestablishment of the chum salmon program in 1989 and, using prescribed sockeye salmon egg-take methods, 16 million chum salmon eggs were taken and are now being incubated. Fish produced by Russell Creek Hatchery will be taken by fishermen in the Sand Point-King Cove-False Pass area.

Because of a very weak odd-year run of pink salmon in Russell Creek, a cooperative effort with Kitoi Bay Hatchery was undertaken in the fall of 1987. A total of 10 million eyed pink salmon eggs was transferred to Russell Creek, incubated, and released in the spring of 1988. In the fall of 1988, 2 million pink salmon eggs from the natural Russell Creek stock were taken. In the fall of 1989, the pink salmon adults from the Kitoi Bay transfer returned to Russell Creek in unexpectedly large numbers: an estimated 80,000-90,000 fish. Ten million eggs were taken and are being incubated.

No coho salmon eggs were taken in the fall of 1988; however, 34,000 smolts from the 1987 egg take were released into Russell Creek in the spring of 1989. This program has been reintroduced into the hatchery based on the desires of Cold Bay residents who will pay for the costs for a coho salmon program sport fishery. Thirty-five thousand eggs will be taken in the fall of 1989.

A special sockeye salmon incubation building (actually a separate, small hatchery), which was designed and constructed by the Russell Creek Hatchery staff in the summer and fall of 1988, was stocked with 1.4 million sockeye salmon eggs taken in September 1988, and almost 1 million healthy fry were stocked back into Mortensen Lake in the spring of 1989. The sockeye salmon incubation module worked flawlessly in its first trial year, and no IHN virus was detected in any of the sockeye salmon fry. The fry ate and grew well during the short rearing period. During a FRED Division regional review, it was decided to use available funding to evaluate potential sockeye salmon production at other locations rather than to take eggs this year. It was felt that the money spent on these investigations would provide greater long-term benefits.

The 1989 egg take at the Russell Creek Hatchery was the largest in the 11-year history of the facility. The 26 million-egg egg take of chum, pink, and coho salmon exceeded the preseason goal by 6 million eggs and represented an outstanding effort by staff there.

Kitoi Bay Hatchery is located on Afognak Island at the head of Kitoi Bay at the north end of Marmot Bay. The metal frame and asbestos-insulated hatchery building was

constructed in 1965 following destruction of the facility during the 1964 earthquake. The hatchery office, shop, incubation facilities, and heated storage area are located in this building. Two 70-ft aluminum raceways were installed in 1988, along with a tailrace, transport channel, and two steep pass ladders. A seawater pump was installed in 1989 capable of supplying sea water to the hatchery incubation area, which can be used for fungus control instead of chemical treatment. A sockeye salmon incubation module was installed at the facility in 1989 by modifying what was once the fin-clipping area. This room gives the hatchery a capacity to incubate over 4 million sockeye salmon to emergent fry. Water for the hatchery and domestic use is supplied from Big Kitoi Lake via 1,600 feet of 14-inch pipeline, with approximately 100 feet of head between the facility and the lake. Cold water used to incubate chum salmon eggs and the early stages of pink salmon egg incubation is supplied by a second 14-inch pipeline installed in 1986 which draws water from 55-ft-down in the lake. Chum and sockeye salmon incubation water is treated by ultraviolet light prior to contact with the eggs.

The primary group served by Kitoi Bay Hatchery is the Kodiak commercial purse-seine salmon fishermen. Approximately 385 purse-seine and 30 beach-seine permits are registered in Kodiak. Sport and subsistence fishermen comprise the secondary groups, harvesting fish stocked along the Kodiak road system by the hatchery.

The main goal of the Kitoi Bay Hatchery is to increase the number of returning adult pink, chum, sockeye, and coho salmon available to the fishery, and to increase the commercial harvest in areas that historically did not produce good or sustained catches; i.e., cape fisheries in the Duck Bay/Izhut Bay areas. In conjunction with the ADF&G, Sport Fish Division, Kitoi Bay Hatchery provides coho salmon fingerlings for programs designed to create recreational salmon and trout fisheries along the Kodiak road system.

A pilot project using zero-check sockeye salmon was initiated in 1989 and judged a success. Smolts averaged 2 g-3 g in size at release and were the same size as naturally occurring zero-check sockeye salmon smolts in the wild. This project is expected to produce several hundred thousand sockeye salmon for harvest in the future. A coho salmon smolt production program also was started which also will contribute several thousand adults to future harvests.

No disease problems occurred in any of the stocks of fish utilized at Kitoi Bay Hatchery in 1989. No IHN virus was found among chum salmon fry or returning adults. BKD sampling occurred in returning adult chum salmon with negative results. BKD sampling in Little Kitoi coho salmon found one fish positive at a very low level. Continued sampling will occur in this species next year. A nitrogen-supersaturation problem developed in the start tanks at the hatchery in young sockeye salmon. The fish recovered shortly after being placed in seawater pens. This problem will be corrected prior to next season.

Kodiak and Alaska Peninsula Highlights

- ° There was a total return of 7,620,000 pink salmon to Kitoi Bay Hatchery in 1989. The commercial catch was 0 (due to the Exxon Valdez oil spill), the cost-recovery harvest consisted of 6,490,000 fish, and broodstock and escapement consisted of 1,130,000 adults.
- ° There was a total return of 3,500 adult chum salmon to Kitoi Bay Hatchery.

- ° Sockeye salmon spawner returns (35,000 fish) increased for the seventh consecutive year to Upper Thumb River at Karluk Lake.
- ° 1989 was the first year of hatchery broodstock returns to the Village of Ouzinkie Scientific Educational Facility. Stocking 22,000 coho salmon fry in 1987 with the assistance of FRED Division area biologists resulted in a personal-use catch of 1,000 and an escapement of 546 adult coho salmon this year.
- ° A total of 120 million pink salmon, 2,150,000 chum salmon, and 90,000 coho salmon eggs were taken for continuation of salmon enhancement at Kitoi Bay.
- ° A total of 4,000 adult coho salmon returned for sport fisheries enhancement in Kodiak.
- ° Five million sockeye salmon eggs at Upper Station Lake were collected to develop the feasibility of zero-check sockeye salmon fish culture at Kitoi Bay Hatchery.
- ° Nearly 175 tons of fertilizer was applied in Karluk and Frazer Lakes to increase survival of sockeye salmon in cooperation with the U.S. Fish and Wildlife Service (USF&WS) and KRAA.
- ° In 1989 there was successful incubation of 86,000 pink salmon and 1,000,000 sockeye salmon eggs to the eyed stage at the Pillar Creek Hatchery in Kodiak. Egg survivals of over 90% were obtained and the eggs were shipped out for other project use to Terror River and Kitoi Bay Hatchery.
- ° Drilling of a 10-in well at Pillar Creek Hatchery was completed in cooperation with KRAA. This backup water supply is capable of delivering 380 gpm of water, which is half of the hatchery's water needs.
- ° A prestocking assessment at Spiridon Lake for sockeye salmon enhancement was continued. The lake outlet was assessed for smolt survival by dropping 1,200 sockeye salmon smolts over the barrier falls. The mortality rate exceeded 20%, so a weir and pipeline will be built to avoid mortality once the lake is stocked.
- ° Prefertilization studies were continued at Akalura and Afognak Lakes for sockeye salmon. Both lakes are at their desired escapement level, but the return per spawner ratio is below the desired level.
- ° A lake rehabilitation project was initiated at Malina Lake in cooperation with KRAA. Survey results indicate a remnant population of less than 1,000 sockeye salmon using a lake system capable of supporting a run of up to 15,000.
- ° A chinook salmon sport fisheries enhancement project was initiated by stocking 114,400 smolts into Island Lake after a long transport by a SeaLand Barge from Elmendorf Hatchery in Anchorage.
- ° A half-length coded-wire tag study of adult sockeye salmon at Karluk Lake was completed. Results indicate sockeye salmon fry can be successfully tagged; however, the tag appears to be shed over time, as very few adults retained their tag.

- Instream fry-survival studies at Terror and Kizhuyak River under agreement with the Alaska Power Authority were continued. About 86,000 eyed pink salmon eggs from Pillar Creek Hatchery were planted in Terror River to evaluate instream survivals affected by hydroelectric water demands.
- The Japanese Overseas Fishery Cooperation Foundation-Alaska cooperative project begun in 1987 was continued. Efforts of this project were not successful in capturing Weathervane scallops. State participation in the project ended in October. One native village continues to culture pink scallops.
- Two new mussel farm enterprises were continued. One culturist is capturing mussels at the southwest side of Kodiak Island and another culturist is growing-out these same mussels on the north end of the island. Permitting remains a problem for these new enterprises.
- Oil assessment studies were begun in the Kodiak area for early marine survival of salmonids in the presence of oil spilled by the Exxon Valdez.
- A regional planning team for the Alaska Peninsula is being formed, and the future formation of a regional association is under active discussion.
- The Volcano Club, a community organization which sponsors the Silver Salmon Derby, donated \$450 to Russell Creek Hatchery to be used for the production of coho salmon smolts.
- Russell Creek Hatchery had the largest egg take in its history, with 26 million chum, pink, and coho salmon eggs being incubated. The egg take exceeded the established goal for the year by 6 million eggs.
- The Russell Creek Hatchery sockeye salmon program begun last year in the newly constructed incubation building was a success. The hatchery building and its systems performed flawlessly, resulting in the release of almost 1 million healthy fry with no IHNV detected in either the eggs or fry.
- Adult returns to Russell Creek from an experimental transfer of eyed pink salmon eggs from Kitoi Bay Hatchery in the fall of 1987 numbered around 85,000. Odd-year returns of natural pink salmon stocks to Russell Creek are insignificant, sometimes numbering only hundreds of fish.
- Kitoi Bay Hatchery produced 98% of the entire Kodiak Island pink salmon harvest and 100% of the Afognak District harvest.
- A room in the hatchery building at Kitoi Bay Hatchery was modified to become an isolation room for incubating sockeye salmon eggs. The modification was paid for by KRAA. At full capacity, a total of 4.2 million eyed eggs can be held for emergent fry.
- Over 80 million pink salmon fry and 3.3 million chum salmon fry were reared and released from Kitoi Bay Hatchery, as well as the volitional release of over 400,000 pink salmon fry. Additionally, 530,000 coho salmon fingerlings were stocked into lakes.

- ° A new program was started at Kitoi Bay Hatchery with the introduction of eggs from a zero-check sockeye salmon population. A total of 144,000 very healthy smolts was released.

Kodiak and Alaska Peninsula Returns and Fishery Contributions

A strong return of adults from a transplant of Kitoi Bay Hatchery odd-year pink salmon eggs resulted in 80,000-90,000 fish entering Russell Creek (See Table 1), an unheard-of figure for an odd-year run in this stream.

Contributions of hatchery-produced fish to the Cold Bay area commercial fishery were negligible this year, as only five-year chum salmon were expected to return; approximately 15,000 were used as broodstock or escapement. Although a large number of pink salmon returned (about 85,000), their presence was not apparent in the salt water, so no harvest occurred in Cold Bay.

In 1989 the cost-recovery program at Kitoi Bay Hatchery was an important cooperative program that was successfully implemented. More than \$10,614,000 was generated from this program. These program receipts will be used by KRAA for the hatchery operation's cost and for capital construction at Kitoi Bay Hatchery. This program is consistent with the terms of an agreement between the state and KRAA, which was worked out by the FRED Division, the ADF&G, Commissioner's Office, and the Attorney General's Office as an emergency response to prevent the returns from "rotting on the beach." The catch at Kitoi Bay accounted for 98% of the Kodiak area pink salmon harvest. This unusually high cost recovery was a result of the expanded rearing program at Kitoi Bay Hatchery, total closure of commercial fishing in the Afognak and northern Kodiak areas, and effective protection from oil in the inner Kitoi Bay area.

In 1989, 92 Kodiak area permitholders harvested 182,000 pink, 1,290,000 sockeye, 20,000 chum, 2,600 coho, and 100 chinook salmon. The total salmon catch of 1,492,400 fish has an ex-vessel value of approximately \$11,699,000 million (an average of \$127,163 per permitholder). The 1989 salmon fishing year was heavily impacted by the Exxon Valdez oil spill incident which forced the closure of most salmon fishing areas due to the presence of oil in nearby areas. The only open-fishing areas were in Olga Bay and the inner Karluk Lagoon. Because of the extensive island-wide closures and the record return to Kitoi, the cost-recovery program harvested 98% of the total pink salmon for the Kodiak area.

In 1989 the Kitoi Bay Hatchery had a return of approximately 7,620,000 pink salmon adults, and a total of 3,500 chum salmon adults returned to the Kitoi Bay area. Also, a return of more than 5,200 coho salmon resulted from stockings in Kodiak Island systems, but exact information on the number of fish caught by sport, subsistence, and commercial fishermen from hatchery-contribution fish is not available for the coho salmon fisheries, since no marking or mark-recovery program exists. Escapements are estimated. A sport catch of landlocked coho salmon is included in the total sport catch.

Kodiak and Alaska Peninsula Releases

Almost 2 million pink salmon fry were released in the spring of 1989 from Russell Creek Hatchery from the fall 1988 egg take.

There were 932,000 sockeye salmon fry released from Russell Creek Hatchery into Mortensen Lake in the spring of 1989.

Thirty-four thousand coho salmon smolts were released from Russell Creek Hatchery in the spring of 1989.

Over 80 million pink salmon fry were released from Kitoi Bay Hatchery after an intensive rearing program. In addition, 3.3 million chum salmon were fed prior to release and 144,000 sockeye salmon smolts were released.

Kodiak and Alaska Peninsula Egg Takes

There were 16 million chum salmon eggs, 10 million pink salmon eggs, and 35,000 coho salmon eggs taken at Russell Creek Hatchery this year.

Kitoi Bay Hatchery once again led the state-owned and operated hatcheries in the number of eggs taken and incubated with approximately 127 million.

ARCTIC-YUKON-KUSKOKWIM

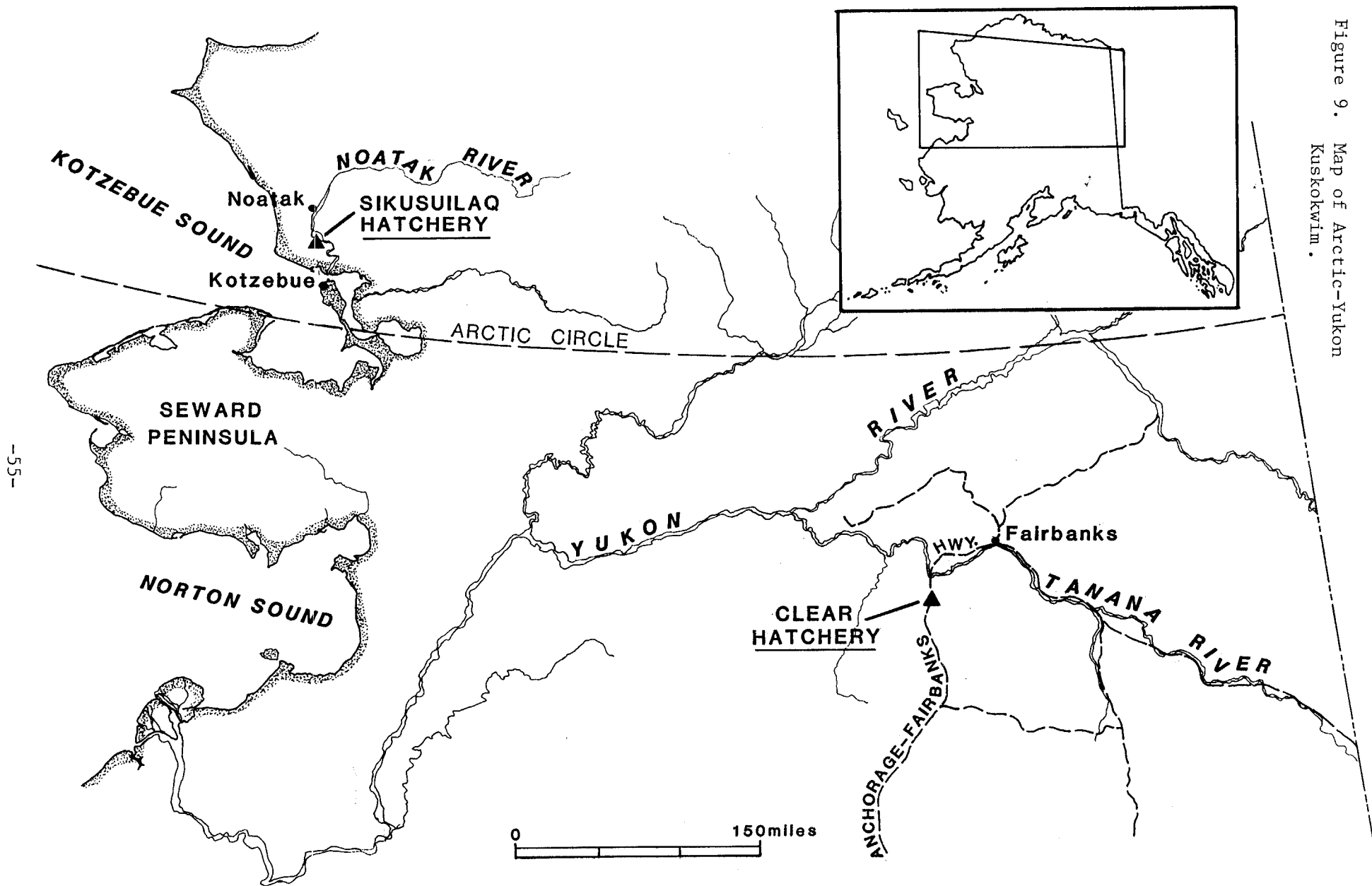
Summary of FRED Projects

Two FRED Division hatcheries are located in the Arctic-Yukon-Kuskokwim (AYK) region. Clear Hatchery at the Clear Air Force Station produces rainbow trout, grayling, Arctic char and lake trout for Interior sport fisheries. Sikusuilaq Springs Hatchery on the Noatak River near Kotzebue produces fall chum salmon for the Kotzebue area commercial and subsistence fisheries. Evaluation of the Sikusuilaq Springs Hatchery returns is done by the FRED Division area biologist in Fairbanks.

Clear Hatchery, near Nenana, was completed in January 1980. Clear Hatchery has produced coho salmon, sheefish, Arctic grayling, Arctic char, lake trout, and rainbow trout predominantly for Interior sport fisheries and, historically, produced fall chum, chinook, and coho salmon for the Tanana/Yukon River commercial and subsistence fisheries. Since Clear Hatchery is interior Alaska's only hatchery, it is a center for developing rearing programs for Interior fishes. The site was selected partly due to the availability of heated waste water which allows for a flexible rearing program.

The Arctic char project is designed to develop, maintain, and expand domestic broodstock to supplement and eventually replace wild-stock egg takes and to continue to provide fingerlings, subcatchables, and catchables for Interior and Southcentral sport fish programs. The Arctic grayling project is designed to maintain and expand a domestic broodstock to replace a wild egg take and to continue to provide fry and fingerlings for statewide sport fisheries projects. Additional emphasis is placed on developing techniques to increase survival levels at all stages of fish culture. The domestic sheefish program has replaced the wild egg take, and efforts have continued to refine culture techniques to provide a unique sport fish program in a few selected Interior lakes. This has been a very successful fish cultural program, but the sheefish have not survived well after release in a number of cases and have not contributed significantly to the sport fish harvest, so the program has been discontinued. The lake trout program presently

Figure 9. Map of Arctic-Yukon
Kuskokwim.



depends on a remote egg take from a wild broodstock to ultimately provide enhancement and a mixed fishery in a limited number of lakes. The rainbow trout program has consisted of rearing young fish to fingerlings and subcatchables, from eyed eggs received from the Fort Richardson Hatchery domestic stock, to enhance Interior sport fisheries opportunities. Beginning in 1990, this program will be implemented entirely by Fort Richardson Hatchery.

The Sikusuilaq Springs Hatchery is located on the Noatak River approximately halfway between Kotzebue and Noatak Village. Funding came from the 1978 Bond Issue and construction costs were about \$3 million. The original legislative intent was for a demonstration hatchery to be built and operated at a suitable site in the Kotzebue area so that the practicality of hatchery operations in the Arctic could be assessed and information gathered for the design of a full-production salmon hatchery, if the original operation was successful. During 1987 the capacity of the hatchery was expanded from 2 million to 10 million eggs. So far all indications show that annual returns from a 60 million egg-production hatchery at Sikusuilaq could produce at least one-half million adult chum salmon for harvest by the Kotzebue Sound commercial fishery. Design of the production hatchery has reached the schematic stage and staff are currently initiating planning and review for the possible expansion. Overall costs for design and construction are currently estimated at \$9.75 million.

1989 was the second year of production at Sikusuilaq Springs Hatchery using the equipment installed during the 1987 expansion to a 10 million-egg capacity. During September 1988, 6.6 million eggs were collected for incubation; of these, 6 million survived until release as fed fry in June 1989. The incubation and water-aeration systems performed well and the fry that emerged from the incubators were the healthiest ever. The emergent fry were held in the outside fish-holding tanks for six weeks of rearing. Fry growth was not as good as expected, primarily due to the cold water temperatures and high silt loads caused by an extended period of flooding during the abnormally severe spring breakup.

A survey of potential rehabilitation projects in the Nome area was continued this year with the ADF&G, Commercial Fisheries and Habitat Divisions and with the Bureau of Land Management. Three projects have been selected for closer study: (1) an incubation project for pink or chum salmon in the Nome River where overfishing has severely reduced runs, (2) a lake fertilization feasibility study for Salmon and Glacial Lakes to increase local sockeye salmon production, and (3) a rechannelization study for the East Fork of the Solomon River to increase Arctic grayling or Arctic char production.

Arctic-Yukon-Kuskokwim Area Highlights

- ° Record snowfall and cold combined to cause a severe spring breakup with water levels 6 feet higher than previously recorded at Sikusuilaq Springs Hatchery. The extreme high water submerged the spring pumphouse and caused cold temperatures and high silt in the rearing raceways that retarded fry growth. The high water came within inches of releasing all the fry prematurely. Damage to the pumphouse and its equipment required several weeks and a few thousand dollars to repair.
- ° Overall survival of chum salmon eggs in the Sikusuilaq Springs Hatchery was better than ever before: 92%. The June 1989 fry release of 6 million was double the previous record.

- ° Better-than-expected returns of adult chum salmon to Sikusuilaq Creek during September 1989 resulted in an egg-take record of 9.2 million green eggs.
- ° Approximately 85,000 Arctic char were stocked from Clear Hatchery into 27 Interior and Southcentral lakes.
- ° Almost 1.5 million Arctic grayling fry were stocked from Clear Hatchery into 30 lakes statewide, and 90,000 fingerlings were stocked into 24 lakes statewide.
- ° All 110,000 available sheefish fingerlings were stocked from Clear Hatchery into one Interior lake for enhancement.
- ° A total of 94,000 lake trout was stocked from Clear Hatchery into 24 Interior lakes.
- ° A total of over 500,000 rainbow trout fingerlings was stocked from Clear Hatchery into 34 lakes and the 30,100 subcatchable-sized rainbow trout were stocked into 8 Interior lakes.
- ° A record number of Arctic grayling eggs from the 1986 hatchery broodstock at Clear Hatchery was taken; the unfed fry-release goal of 1.0 million was surpassed by 49%.
- ° There were record returns of fall chum salmon to Sikusuilaq Springs Hatchery near Kotzebue. Although the hatchery was still in a demonstration phase, preliminary estimates indicate that fish released four years ago contributed about 6% or 14,000 fish to this year's commercial fishery and about 40% to Noatak River subsistence fisheries.
- ° An estimated 22,000 fall chum salmon returned to Sikusuilaq Springs Hatchery this year. Many of them used a new experimental fish ladder. Over 9 million eggs were taken—a new record.
- ° A high school volunteer from Anderson operated the Wood Creek weir this year as a school project. His diligent work allowed ADF&G to evaluate past releases of coho and fall chum salmon from Clear Hatchery.
- ° FRED Division personnel from Fairbanks and Clear Hatchery volunteered their own time to assist schools in setting up experimental salmon incubation programs this year. This work included assisting the Tok School in obtaining fall chum salmon eggs for an egg plant in the Tok River, providing coho salmon eggs for an incubator at the Denali Elementary School, and assisting the North Pole Middle School in setting up an incubation/rearing system for fall chum salmon and obtaining eggs.

Arctic-Yukon-Kuskokwim Area Returns and Fishery Contributions

Approximately 22,000 adult chum salmon from Sikusuilaq Springs Hatchery releases returned to the Kotzebue area during the summer and fall of 1989. The commercial fishery harvested about 14,000 of these fish; this was nearly 6% of the total harvest and had a value to the fishermen of about \$40,000. Subsistence users harvested at least 2,000 of these returning fish and the remainder returned to Sikusuilaq Springs Creek.

An estimated total of 2,000 adult chum salmon from Clear Hatchery were caught by the commercial fishery. Interior lakes boasted sport catches of Clear Hatchery-produced fish of 32,300 coho salmon, 60,000 rainbow trout, 26,000 grayling, and 1,000 rainbow trout. Rainbow trout planted by Fort Richardson Hatchery into Interior lakes contributed 30,000 fish to the sport fishery.

Arctic-Yukon-Kuskokwim Area Egg Takes

An estimated 8.25 million eggs were taken for incubation this year from Sikusuilaq Springs Creek, and an additional 1 million eggs were collected from spawning areas on the Noatak River from an estimated 6,000 adult chum salmon that returned from previous releases at Sikusuilaq Springs Hatchery.

Approximately 488,000 Arctic char eggs were taken by Clear Hatchery as well as 2,800,000 Arctic grayling, 125,000 lake trout, and 488,000 sheefish eggs.

PROGRAM PROJECTIONS FOR 1990

The FRED Division utilizes many strategies for rehabilitation, enhancement, and development of fisheries other than hatcheries. Several of these strategies, including operation of fish ladders to allow salmon to reach unutilized spawning areas, lake fertilization, habitat improvement, and fish-planting programs are much more difficult to evaluate than standard hatchery production. With lake fertilization and fish-planting projects, tagging and use of sonar counters allows for evaluation, often on a par with hatchery evaluation, but at a much greater cost. Fish ladders and habitat improvement projects are difficult to evaluate; i.e., estimating the increased number of fish attributable to a project. In many cases, if evaluation is biologically feasible, it is cost-prohibitive. Since hatchery production is the most quantifiable strategy, it often is used as the standard by which the effectiveness of fisheries enhancement is measured. Table 4 presents projected numbers of fish expected to return to a diverse group of FRED Division projects, not including fish pass projects or projects involving transfers of eggs or fish to PNP cooperators.

The numbers of salmon that returned in 1989 as a result of FRED hatchery operations met or exceeded many of the projected values. The obverse was equally true; some of the returns were lower than projected values. Overall, the 1989 projection presented in the 1988 annual report was far less than half of the actual estimated production in 1989. This was due primarily to the Kitoi Bay Hatchery pink salmon return of over 7 million fish when just over 2 million had been projected. Our prediction for pink salmon in 1989 was low due to a major portion of pink salmon production capacity that had been operationally transferred to the private sector. The unusually high marine survival of pink salmon returning to Kitoi Bay Hatchery was a pleasant surprise.

Projected Returns for 1990

A statewide total of over 7.1 million salmon is expected to return to FRED projects in 1990 (Table 4). Pink salmon comprise the largest segment of the projected returns, primarily to Kitoi Bay, Russell Creek, and Tutka Bay Hatcheries and to the Halibut Cove project. The projection for 1990 and for the second year is for sockeye salmon to be the second-largest segment of the 1990 returns. The projection for 1989 proved to be correct in that sockeye salmon were the fish produced in next to the greatest numbers by FRED Division in 1989. It is of interest that sockeye salmon comprised the second-largest component in the FRED 1988 return, although it was not projected in 1987. The trend is following the FRED Division's sockeye salmon initiative. Major sockeye salmon producers for 1990 will include Tustumena, Big Lake, Gulkana, Chenik, Karluk, Hidden, McDonald, Hugh Smith, and Leisure Lakes. With the exception of steelhead trout, the 1990 return projections for all species is greater than the 1989 projections.

Table 4. A projection of the number of salmon expected to return in 1990 as a result of FRED hatcheries and projects (excluding fishways and PNP transfers).

Return site	Numbers by species					
	Chinook	Coho	Sockeye	Chum	Pink	Steelhead
ARCTIC-YUKON-KUSKOKWIM						
Sikusuillaq				20,000		
AREA TOTALS:				20,000		
COOK INLET						
Big Lake		8,700	207,000			
Cottonwood Drainage		2,300				
Wasilla Creek		1,500				
Jim Creek		1,400				
Sheep Creek	500					
Montana Creek	450					
Willow Creek	2,300					
Little Susitna		25,100				
Crooked Creek	9,500	5,000				150
Chenik Lake			150,000			
Paint River			25,000			
Tustumena			200,000			
Tutka				8,180	900,000	
Halibut Cove	2,880				300,000	
Homer Spit	4,060	7,100			9,000	
Seldovia Bay	2,500	850				
Leisure Lake			125,000			
Port Dick Lake			25,000			
Kirschner Lake			30,000			
Caribou Lake		2,250				
Resurrection Bay	1,500	10,000				
Ingram Creek		200			500	
Ship Creek	3,000	2,500				
AREA TOTALS:	26,690	66,900	762,300	8,180	1,209,500	150
KODIAK-AK. PENINSULA						
Karluk			200,000			
Kitoi outstocking		25,000		5,000	3,159,000	
Kodiak Lakes	300	5,000				
Russell Creek				15,000		
AREA TOTALS:	0	4,200	200,000	20,000	3,159,000	0

Table 4. Continued.

Return site	Numbers by species					
	Chinook	Coho	Sockeye	Chum	Pink	Steelhead
PRINCE WILLIAM SOUND						
Cordova		5,000				
Gulkana			234,500			
Main Bay			10,000	840,000	200,000	
Whittier		5,000				
Valdez						
AREA TOTALS:	0	10,000	244,500	840,000	200,000	0
SOUTHEAST - SOUTHERN						
Bakewell/Badger			4,400			
Big Salt	507					
Cable Creek		210				
Craig	18					
Deer Mountain	2,040	3,640				
Hugh Smith Lake			4,700			
Klawock		80,600	6,700	6,000		1,800
Marx Creek				30,300		
McDonald Lake			92,000			
Murphy's Landing	51					
Reflection Lake		1,080				
Thorne Bay	77					
Tunga Inlet		15,500				
Ward Creek		2,780				225
SOUTHEAST - CENTRAL						
Crystal Lake	15,700	8,000				50
Earl West Cove	6,100					
Farragut River	325					
Harding River	50					
Ohmer Creek	700					
SOUTHEAST - NORTHERN						
Chilkat Ponds		1,250				
Indian Lake		140				
Juneau/DJ	1,800	11,500				
Snettisham	700	2,500		97,000		
AREA TOTALS:	28,068	127,200	107,800	133,300	0	2,075
STATE TOTALS:	54,758	208,300	1,314,600	1,021,480	4,568,500	2,225
GRAND TOTAL:			7,169,863			

PROGRAM ELEMENTS

Sport Fisheries Enhancement Program

The sport fisheries enhancement program implemented by the FRED Division is large and complex. It involves coho, chinook, pink, and sockeye salmon, rainbow, lake, and steelhead trout, Arctic grayling, Arctic char, and sheefish. Lifestages stocked include unfed fry, fed fry, fingerlings, presmolts, smolts, postsmolts, and catchable-sized fish; these were released from nine facilities into approximately 65 stocking locations for anadromous fisheries and into approximately 300 stocking locations for landlocked fisheries.

Review meetings and planning sessions are frequently held with ADF&G, Sport Fish Division personnel, regional planning teams, and other interested parties to improve the program whenever possible. The intent is to keep this complex program as comprehensive and responsive as possible. There continues to be a solid and increasing public demand for additional sport fish production via the hatchery system.

Highlights of the 1989 sport fisheries enhancement program include:

- ° Enhancement of the sport fishery in Prince William Sound and Copper River Basin continues to be a high priority for the FRED Division. Coho salmon smolt stocking from Fort Richardson Hatchery was continued in 1989 at Whittier and Cordova. Adult returns to both locations are popular with both residents and seasonal visitors. A large rainbow trout program, also based out of Fort Richardson Hatchery, was continued in 1989. This program involves stocking both catchable and fingerling rainbow trout in road-accessible lakes along the Richardson and Glenn Highways. A similar program with Arctic grayling is conducted out of Clear Hatchery. Finally, an attempt is being made at Harding Lake in the Interior to establish a kokanee (landlocked sockeye salmon) fishery. Fry from Gulkana I Hatchery are being used in this experimental program.
- ° Prince William Sound sport fishermen harvested an estimated 4,000 coho salmon returning from FRED coho salmon smolt releases.
- ° Over 208,000 Arctic grayling fry from Clear Hatchery were stocked in 12 Prince William Sound lakes to increase area sport fishing opportunities.
- ° Sport fishing continued to expand in importance across southern southeast Alaska. Charter operations increased to 101 operators, with 65 serving the Ketchikan area and 36 from the Prince of Wales Island West Coast group. These operations are requiring more supplemental production of chinook and summer coho salmon, while freshwater fishermen request primarily coho salmon and steelhead or rainbow trout.
- ° Over 112,000 catchable and fingerling rainbow trout from Fort Richardson Hatchery were stocked in 12 Prince William Sound lakes to benefit area sport fishermen.
- ° In 1989 the Crooked Creek Hatchery expanded production by initiating a coho salmon sport fish enhancement program. Utilizing an innovative, moist-air incubation procedure, approximately 80,000 age-0.1 coho salmon smolts will be

produced. In addition, a new building over the outside raceways was completed at the Crooked Creek Hatchery in 1989 to rear up to 300,000 chinook salmon to the smolt stage.

- The fourth year of a personal-use dipnet fishery in Ketchikan Creek produced good results, as 177 excess chinook salmon were harvested by 100 people during the one-day opening.
- The chinook salmon smolt-release project at Halibut Cove Lagoon has involved release of over 1.4 million chinook salmon smolts since 1974 with the objective of increasing sport fishing opportunities in the Kachemak Bay area. This is the oldest and one of the most popular sport fishing enhancement projects in lower Cook Inlet. Over 3,020 chinook salmon returned to Halibut Cove Lagoon in 1989, representing the fourth largest return to that site.
- Over 15,000 salmon caught on the Homer Spit have created an extremely popular, family-oriented fishery; in 1989 an estimated 3,000 chinook, 10,000 pink, and 2,500 coho salmon were harvested by anglers. Over 39,000 salmon were harvested from various enhancement projects in the Kachemak area.
- The Homer FRED and Sport Fish Divisions received a commendation for Meritorious Service for sport fisheries enhancement from the City of Homer and the South Peninsula Sportsmen's Association (SPSA).
- As part of a unique educational experience, students from local high school classes participated in a coho salmon egg take at Big Lake Hatchery, and egg processing and four classroom incubators were installed at local schools.
- In 1989, 124,000 coho salmon smolts, 337,000 chinook salmon smolts, and 9,390, 6- to 8-in coho salmon from Snettisham were stocked in the Juneau area.
- An estimated total harvest of 9,373 Crooked Creek chinook salmon were sport-caught in 1989. This is second only to last year's record catch and exceeded the 1989 early-run Kenai River chinook salmon sport harvest by 2,000. The total return to Crooked Creek was 13,346 chinook salmon of which 66% were hatchery-produced.
- The total contribution of hatchery-produced (combined PNP and state facilities) coho salmon caught in the Resurrection Bay shore and boat sport fisheries in 1989 was 37%, or 6,370 of the 17,416 coho salmon sport-harvested. In addition, a total of 825 hatchery-produced chinook salmon were caught by anglers in Resurrection Bay.
- Over 800 chinook salmon were harvested by sport fishermen in the Juneau area during the first major return year of the Juneau sport fish-stocking program implemented from Snettisham Hatchery.
- The total return of coho salmon to Crooked Creek was 8,300, of which 55% (4,570) were hatchery-produced. An estimated 2,000 coho salmon were caught in the sport fishery, of which 1,100 were hatchery-produced.
- An estimated 90% of the 14,000 coho salmon sport-harvested from the Little Susitna River were of hatchery origin. The estimated smolt-to-adult survival rate

for hatchery-produced coho salmon in the Little Susitna River ranged between 7% and 9%.

- ° Over 20% of the chinook salmon harvested in the Juneau salmon sport fishery during the last three years were hatchery fish.
- ° A detailed program/project review for northern Cook Inlet was held by the FRED Division. The ADF&G, FRED, Sport Fish, and Commercial Fisheries Divisions considered results from evaluation work and opted for coho salmon operations at Big Lake Hatchery to become focused on coho salmon smolt production. Eliminated were the fingerling and presmolt programs. The ultimate goal is to liberalize weekend-only regulations for Knik Arm tributaries.
- ° An estimated 20% of the 1989 chinook salmon harvest in the Petersburg marine sport fishery was attributed to Crystal Lake Hatchery stocks.
- ° An estimated 37% of the 2,500 chinook salmon sport-harvested at Willow Creek were of hatchery origin. Because of the hatchery contribution, fishing-time regulations have been liberalized from 12 to 22 days per season.
- ° Chinook salmon smolts were transported from Elmendorf Hatchery (via SeaLand container ship) to Kodiak Island and released to create a new sport fishery in Kodiak.
- ° In 1989 an estimated 11,000 adult chinook salmon and 7,640 adult coho salmon harvested by Southcentral sport fishermen were from Elmendorf Hatchery releases. In addition, salmon have been stocked into landlocked lakes to create additional roadside fishing opportunities.
- ° Approximately 6.1 million rainbow trout eggs were taken at the Broodstock Development Center in April 1989, exceeding the original goal by more than 20%.
- ° Nearly 50% of the fish harvested by anglers in the Tanana River drainage are hatchery-produced rainbow trout, Arctic grayling, and coho salmon.
- ° The sport fishery enhancement program has created a substantial winter fishery in the Fairbanks area (approximately half the annual harvest of stocked fish).
- ° Over 70% of the rainbow trout caught by anglers from roadside fisheries in southcentral Alaska are hatchery-produced.
- ° To meet all requests, 3.21 million rainbow trout fingerlings and a new record of 283,000 catchable-sized rainbow trout were released from Fort Richardson Hatchery, setting a new season record.
- ° Over 18,000 angler-days were spent fishing in the Kepler Lakes complex near Palmer in 1988 and 1989.
- ° Shore anglers spent nearly 27,000 angler-days to harvest 8,428 chinook salmon in the Kasilof River sport fishery in 1989. In addition, a total of 945 chinook salmon were reported caught by clients of sport-fishing guides operating on the Kasilof River. The total sport harvest in 1989 of 9,373 was second only to last year's record catch of 11,200, and was 2,000 more chinook salmon than the 1989

harvest in the early-run of the Kenai River. Since 1984 the annual sport harvest of chinook salmon in the Kasilof River has exceeded that for the early-run chinook salmon of the Kenai River during the last three years.

- An estimated 4,000 adult coho salmon returned to waters near the City of Kodiak for sport fisheries enhancement.
- The Volcano Club, a community organization which sponsors the Silver Salmon Derby, donated \$450 to Russell Creek Hatchery to be used for the production of coho salmon smolts.
- Approximately 85,000 Arctic char were stocked from Clear Hatchery into 27 Interior and Southcentral lakes.
- Almost 1.5 million Arctic grayling fry were stocked from Clear Hatchery into 30 lakes statewide, and nearly 90,000 fingerlings were stocked into 24 lakes statewide.
- A total of 94,000 lake trout was stocked from Clear Hatchery into 24 Interior lakes.
- Over 500,000 rainbow trout fingerlings were stocked from Clear Hatchery into 34 lakes, and 30,100 subcatchable-sized rainbow trout were stocked into 8 Interior lakes.

Commercial Fisheries Enhancement Program

Commercial fishermen statewide benefited from returns of hatchery-produced fish. In Prince William Sound, lower and central Cook Inlet, and Kodiak, substantial portions of the commercial fisheries were not opened due to the Exxon Valdez oil spill.

Highlights from 1989 commercial fisheries enhancement projects include:

- Sockeye salmon returns from Gulkana I Hatchery contributed an estimated \$2 million to the Prince William Sound commercial fishery.
- An estimated 130,000 chum salmon returned to Main Bay Hatchery in 1989, but only 15,000 were harvested in the commercial fishery due to oil-contaminated beaches and water. Approximately 103,000 chum salmon were harvested in the protected area in front of Main Bay Hatchery under a joint sales-harvest agreement with the Prince William Sound Aquaculture Corporation (PWSAC).
- McDonald Lake sockeye salmon continued to demonstrate excellent returns, as a special sockeye salmon seine fishery was opened for the first time in the west Behm Canal; 5,240 fish were harvested.
- Six million pink salmon fry were transported from Tutka Bay Hatchery to Halibut Cove Lagoon as part of a cooperative program with the Cook Inlet Seiners Association (CISA), the City of Homer, the Cook Inlet Aquaculture Association (CIAA), and ADF&G to release pink salmon fry into new, unexploited nursery areas and to disperse the commercial fishery. The return in 1989 from last year's

release of 3 million fry was estimated at 250,000 fish, representing an 8.3% survival rate.

- In 1989 FRED projects accounted for over 67% (nearly 1 million fish) of the \$2.6 million ex-vessel value of the lower Cook Inlet salmon harvest (1,480,000 fish).
- The Chenik and Leisure Lakes stocking projects provided over 73% (119,000 fish, including a 38,900 cost-recovery harvest from Chenik Lake) of the total lower Cook Inlet sockeye salmon harvest in 1989. Ex-vessel value from these two projects was estimated at \$800,000.
- Northern Southeast projects contributed coho salmon to area commercial fisheries, including approximately 1,510 from releases at Snettisham, 5,250 from releases in the Juneau area, 1,000 from the Chilkat River pond rehabilitation project, 672 from Indian Lake stocking, and 237 from Sweetheart Lake stocking.
- Tutka Bay Hatchery had the second-highest return from its fry releases in the facility's 13-year history with an estimated overall ocean survival of 6.3%.
- Tutka Bay Hatchery production and the Halibut Cove Lagoon cooperative rearing project with CISA accounted for 68% (878,117 pink salmon) of the entire 1989 lower-Cook Inlet commercial pink salmon harvest. The ex-vessel value of the harvest was nearly \$1 million.
- Alaska hatchery chinook salmon contributions to the troll fishery in Frederick Sound is growing steadily, approaching 30% in the winter troll catch.
- The harvest goal for the Tutka Bay Hatchery project, as set forth in the Cook Inlet Regional Salmon Enhancement Plan, was an annual harvest of 560,000 pink salmon by the year 1990. The hatchery has exceeded this goal in 1981, 1983, 1988, and 1989.
- A terminal commercial fishery was opened by emergency order to harvest surplus sockeye salmon bound for Big Lake. Approximately 40,000 sockeye salmon were caught.
- Tutka Bay Hatchery's contribution to the lower Cook Inlet salmon fleet has been significant over the life of the facility with production up to 91% of the entire commercial harvest for pink salmon in lower Cook Inlet. This is the second consecutive year that Tutka Bay Hatchery has produced over 900,000 returning pink salmon.
- The number of hatchery-produced sockeye salmon returning from the stocking program in Tustumena Lake totaled 264,000 adults and represented 33% of the run. The number of hatchery-produced sockeye salmon caught in the commercial fishery was 208,000. At an average value of \$1.70 per pound for sockeye salmon in Cook Inlet during the 1989 commercial fishery, the ex-vessel value of hatchery-produced sockeye salmon in central Cook Inlet during 1989 totaled nearly \$1.8 million.
- There was a total return of 7,620,000 pink salmon to Kitoi Bay Hatchery in 1989. The commercial catch was 0 (due to the Exxon Valdez oil spill), the cost-

recovery harvest consisted of 6,490,000 fish, and broodstock and escapement consisted of 1,130,000 adults.

- Adult returns to Russell Creek from an experimental transfer of eyed pink salmon eggs from Kitoi Bay Hatchery in the fall of 1987 numbered approximately 85,000. Normal odd-year returns of pink salmon to Russell Creek are insignificant, sometimes numbering only hundreds of fish.
- Kitoi Bay Hatchery produced 98% of the entire Kodiak Island pink salmon harvest and 100% of the Afognak District harvest.
- Record numbers of fall chum salmon returned to Sikusuilaq Springs Hatchery near Kotzebue. Although the hatchery was still in a demonstration phase, preliminary estimates indicate that fish released four years ago contributed nearly 6% or about 14,000 fish to this year's commercial fishery and nearly 40% to Noatak River subsistence fisheries.

Oil Spill Operations

On 24 March 1989, the Exxon Valdez went aground on Bligh Reef in eastern Prince William Sound. Approximately 11 million gallons of north slope crude oil poured out of the ruptured vessel to create the largest oil spill in North America. The downcurrent drift of this oil spill covered the highly productive nearshore waters and shorelines of Prince William Sound, the Gulf of Alaska, western Cook Inlet, the Kodiak Archipelago, Shelikof Straits, and the Alaska Peninsula. FRED Division facilities were directly impacted by this floating oil at Main Bay Hatchery in Prince William Sound and at Kitoi Bay Hatchery on Afognak Island. Although floating crude oil did not actually reach the Tutka Bay Hatchery on the lower Kenai Peninsula, adjacent shorelines were oiled and a direct impact appeared imminent for a period of several weeks. Area biologists and hatchery managers and their staffs in Prince William Sound, Kodiak, and lower Cook Inlet were immediately involved with the effects of the oil spill as they tried to anticipate where the oil might drift and how it might affect the habitat and activities of state and private facilities. Even though months have passed, the threat to Main Bay, Kitoi Bay, and Tutka Bay Hatcheries continues as oil continues to come off beaches along the hundreds of miles of affected coastline. Hatchery protection was designated high priority in the Governor's Winter Oil Spill Response Plan.

The initial response to the oil spill entailed a highly intense defensive program. All available sources of floating, protective boom materials were immediately located, mobilized, and exhausted in an attempt to install barriers to protect the facilities, important estuarine fish habitats, and communities. This entailed a team effort with direct input at all levels of involvement, including area biologists, hatchery managers and their staffs, volunteers, regional maintenance personnel, regional hatchery managers, the regional biologist, regional administration, the regional supervisor, and headquarters office support. Involvement and effort was intensive and exhaustive; individuals were driven by their commitment to protecting and saving the resource.

Due to the fast reaction and efforts of dedicated FRED Division employees and volunteer groups, the spreading oil was prevented from fouling the estuarine areas immediately in front of hatcheries, but two important factors remained: (1) normal operations were greatly disrupted, and (2) normal commercial fisheries could not operate. Normal operations could not occur because boat traffic could not freely

approach the facilities, oil spill workers wanted to use the facilities as bases for operations, and previously planned release strategies for the young fish had to be adjusted to minimize the likelihood of their being impacted by oil. Many commercial fishery units were not allowed to operate due to oil in the area. Consequently, unusually large numbers of fish returned directly to the hatchery zones. Extraordinary efforts were made in cooperation with local aquaculture associations to utilize excess fish at Kitoi Bay and Main Bay Hatcheries so the fish would not "rot on the beach."

The second response to the Exxon Valdez oil spill began almost as quickly as the initial response. FRED Division biologists became partners in a multifaceted, multiagency scientific oil spill impact assessment team. Talents and resources immediately were pooled to plan and implement field studies to assess and document detrimental impacts of the spill. Within 4-6 weeks detailed studies were initiated, contracts were let, materials and supplies were on-site, and sampling was begun, in spite of a new administrative organization, an adverse logistical situation, and unique legal documentation requirements that are not normally required for scientific studies.

Items deserving special mention as a result of this catastrophic event include:

- ° In Prince William Sound, FRED staff, in conjunction with ADF&G, Commercial Fisheries Division staff, developed and initiated a massive juvenile salmon-tagging project to assess the ocean survival of hatchery and wild salmon fry and smolts passing through oiled areas in Prince William Sound on their migratory route to the Gulf of Alaska. Pink and chum salmon fry from hatchery facilities in Prince William Sound were tagged where they are produced. Sockeye salmon smolts from the Main Bay Hatchery and two lake systems also were tagged. The tagging project is scheduled to continue in 1990 with over 1.9 million tagged juvenile salmon scheduled for release. This project is one of a number of oil spill impact assessment projects designed to help the state and federal agencies assess damages attributable to the Exxon Valdez oil spill.
- ° FRED Division activities in Prince William Sound during 1989 were heavily impacted by the Exxon Valdez oil spill. During the early days of the spill, a great deal of time and effort were expended by area staff responding to information requests about the Prince William Sound hatchery program and the potential effects of the oil spill on hatchery production. Area staff also participated in the impact assessment planning process for the Prince William Sound coded-wire tagging program. It was possible to implement a large portion of the coded-wire tagging program in 1989 due to the expertise available in the FRED Division area and regional offices. The impact assessment tagging program is scheduled to be broadened in 1990 under the direction of FRED Division.
- ° Due to oil spill-related fishery closures, 103,000 chum salmon returning to Main Bay Hatchery were harvested by PWSAC in a protected area adjacent to the hatchery. The harvest generated at least \$400,000 in income; after costs are deducted, the remainder is to be invested on the capital improvement of Main Bay Hatchery (an adult holding and ripening system). This was the result of a cooperative agreement between PWSAC and the state and subsequent action by the Legislative Budget and Audit Committee.
- ° Main Bay Hatchery has been affected by the oil spill since the day following the Exxon Valdez grounding. The chaos of hyperactivity surrounding the spill has been more disruptive to normal hatchery activity than the oil itself. Though staff

attempted to minimize the impact of this activity on normal hatchery operations, they only were partially effective. The primary disruptions were: (1) the installation and maintenance of a complex configuration of oil booms in Main Bay to protect the hatchery from oil; (2) various research groups using the hatchery for a base in their spill-related work; (3) a cost-recovery fishery staged at the hatchery; and (4) the continual influx of unexpected visitors requiring time and energy from workers and distracting personnel from normal activities. The disruptions have moderated somewhat recently, but staff still are experiencing negative consequences from earlier disruptions.

- The FRED Division area biologist from Fairbanks was selected as the principal investigator in a joint-agency effort to determine the impact of the Exxon Valdez oil spill on early marine juvenile salmon. This study is designed to determine the impact of the oil on growth, migration, and habitat of juvenile salmon across the entire area impacted by the spill.
- The salmon fishery in Kamishak Bay in the lower Cook Inlet area was closed due to the presence of oil from the Exxon Valdez spill. A single seine boat was later allowed to conduct cost-recovery operations for CIAA within the confines of Chenik Lagoon. This operation harvested 38,900 sockeye salmon that returned to Chenik Lake with receipts going to CIAA under terms of the Trail Lakes Hatchery Annual Management Plan.
- Oil from the Exxon Valdez was a constant problem at Kitoi Bay Hatchery all spring and summer. At the peak of the influx of oil, over 1,500 gallons of mousse, tar balls, and oiled debris were picked up off the log and inner booms at Kitoi Bay. The oil spill did not allow a competitive commercial salmon season to occur. The FRED Division, the ADF&G, Commissioner's Office, the Attorney General's Office, and the Kodiak Regional Aquaculture Association (KRAA) solidified a cooperative harvest strategy to prevent the returns from "rotting on the beach." KRAA recovered 6.5 million of the returning pink salmon adults in an emergency effort under terms of a cooperative agreement between KRAA and the state.
- Emigration of juvenile pink salmon did not appear to be hampered by the oil booms in place around Kitoi Bay Hatchery. The emigration occurred at the same time as the peak oil contamination in Kitoi and Izhut Bays. Some fry were picked up by oil skimmers working the area. The overall damage resulting from the spill has not yet been assessed.
- The oil booms in Kitoi Bay hampered operation of aircraft and boat traffic to the hatchery. The inconvenience disrupted mail service somewhat and caused extra freight charges to occur since staff were unable to use the vessel, "Puffin," to get small items from town.
- Two temporary employees were hired for the summer to assist in oil-related projects. Three fishing vessels stationed at Kitoi to man the booms did an outstanding job of keeping the inner bay free of oil. Their efforts were greatly appreciated.
- Oil spill impact assessment studies were begun in the Kodiak and lower Cook Inlet areas to assess the impacts of the Exxon Valdez spill on the survival of juvenile salmon during their early marine migration.

Fish Habitat Enhancement and Improvement

FRED Division has continued to develop and pursue fish habitat improvement and enhancement projects in several areas of the state. The goal of these projects is to improve, create, or rehabilitate fish habitat so that long-term productivity of the state's natural waters are improved.

Campbell Creek, in Anchorage, was identified years ago as a candidate for a stream improvement and enhancement project. During 1989 all except for one of the required permits were obtained for a stream rehabilitation project there. Engineering surveys were completed and detailed plans and contracts were drawn-up. The Flood Hazard Permit application is scheduled for completion by mid-December so that final preparations can be completed for project implementation by mid-May 1990. Several meetings have been held with the Alaska Flyfishers, a volunteer sportsman's group, who are willing and anxious to participate in several aspects of new habitat creation and installation, including riprapping of eroding banks and installing spruce tree-instream cover that will stabilize other banks and create shoreline habitat for young fish.

In northern Cook Inlet, rainbow trout spawning habitat was improved by creating small step-pools in a small stream and fish passage. Other sites have been selected for additional work.

In southeast Alaska, there are 17 fishway projects in various stages of implementation; FRED Division is involved in all of these projects. In addition, there are three spawning and/or rearing channels in which FRED personnel are involved. Evaluation work is continuing on the Chilkat Pond project as well.

Ophir Creek, near Yakutat, was the site of instream work in 1989 with four rearing ponds dug in the bed of this chinook salmon stream, which had begun dewatering during low water periods. The ponds will provide refuge for rearing fish.

Modification of a log jam in Steelhead Creek in southern Southeast using a Bell 206 helicopter was accomplished in less than four hours at a cost of \$10,200. Using a D-9 Cat and six people would have taken a minimum of six days. An estimated 40,000 pink salmon moved into the upper reaches of the creek after removal of the jam.

FRED Division, along with the ADF&G, Commercial Fisheries and Habitat Divisions and the Bureau of Land Management, has begun to develop several potential habitat improvement projects in the Nome area. Field data collection has been initiated and strategy meetings have begun. Several fish populations in the area have been depressed, apparently due to intensive fishing and habitat loss.

During 1989 FRED Division personnel participated with personnel from the ADF&G, Habitat Division, the USFS, the Bureau of Land Management, and the USF&WS in implementing the first "Fish Habitat Improvement Workshop" sponsored by the Alaska Chapter of the American Fisheries Society. The workshop was held in Craig, Alaska on 18-25 September. A total of 22 attendees participated in discussions and information exchanges with four presenters in a classroom setting and on field trips. Sessions included: (1) hydrology and stream geomorphology; (2) correlation between riparian habitat, salmonid habitat, and production; (3) factors that limit fish populations; and (4) fish-jumping behavior and problems of fish passage. Attendees and presenters were from state and federal agencies and from private companies.

Mariculture

In 1989 the shellfish mariculture program underwent a major growth phase. Prior to this time, aquatic farms were restricted to a one-year land-use permit that allowed no preference right on renewal. This created problems for the farmers because they had no assurance of continuity from year to year. Financing was difficult. With the implementation and funding of Senate Bill 514, a Department of Natural Resources district opening was held for the regions composing southeast Alaska. Over 50 applications were accepted. Processing is continuing, and the permits for this "batch" will be issued in late spring 1990.

In the meantime, planning is underway to open districts in the remainder of Alaska, which includes: Kodiak, Prince William Sound, and the Cook Inlet area.

Development projects undertaken in 1989 include mariculture feasibility studies in Yakutat, Angoon, and Chenega. Investigation involving cooperative work with farmers and those investigating farming took place in Ketchikan, Metlakatla, Sitka, Craig, Tenakee Springs, Jakalof Bay, Halibut Cove Lagoon, as well as in other areas.

The 1989 growing season was very unusual. It was characterized by very little rain, warm temperatures, and few storms to mix surface waters. Surface seawater temperatures were as high as 19°F. This set of conditions was instrumental in creating very encouraging growth rates of oysters in Yakutat. In five months, oysters reached an average length of about 60 mm. Nearly 10% of the crop was of marketable size. Since the summer was so unusual, these results must be treated with caution for planning purposes. Another year of information is called for and may be supported by the granting agency.

Over 50 Weathervane scallop spat were collected in Yakutat. While this number does not seem large, it is greater than the yield of all of the Weathervane spat collection projects to date, combined. It also is an improvement of the previous year's collection and is based on oceanographic information learned from the previous year. We are getting better at getting Weathervane scallop seed.

Economics

The statewide fishery enhancement program has undertaken a variety of economic studies designed to determine the economic consequences of the program. The purpose of the economics function in FRED Division is to assist in the evaluation of program investments to insure that maximum social and economic benefits are derived from Alaska's extensive application of salmon enhancement technology.

Of the collection of public investments available to Alaska, very few are able to improve the level of economic activity in the state by expanding the total output of the economy. In this regard, the salmon enhancement program is very attractive. It appears that the program offers both increased net benefits as well as additional employment that were produced by increasing the level of economic activity. Preliminary studies undertaken by ADF&G suggest that the FRED program is creating significant net benefits and employment impacts not only in the salmon industry, but throughout the regional economies of Alaska.

Previous estimates for the Governor's Mini-Cabinet on Fisheries suggest that the enhancement program ultimately will generate net state benefits of \$90.0 million for the commercial fishery portion of the program (in 1984 dollars). This results in an overall benefit/cost ratio of 1.4:1. This means that \$1.40 in fish value will be generated for each \$1.00 expended on the program, measuring all benefits and costs in dollars of equal value and discounting them as required when taking into account the time at which they occur. Detailed benefit/cost studies of new and expanded projects in the state's fishery enhancement program suggest that the net benefits of investments made since 1971 may be higher than previously anticipated.

In 1989 the FRED Division economist conducted the following detailed benefit/cost studies:

- ° A detailed benefit/cost study of the Leisure and Chenik Lakes projects that was prepared for the Economics Seminar Series held by the University of Alaska-Anchorage Institute of Social and Economic Research (ISER).
- ° A benefit/cost study of the proposed Turner Lake sockeye salmon project. This was prepared for the Environmental Assessment.
- ° A benefit/cost study of the Main Bay Hatchery sockeye salmon smolt program. This was developed to determine the economic feasibility of state investments in the application of sockeye salmon rearing technology.

Decision makers often are interested in how fisheries investments or management policy may affect economic stability or economic development in various regions of the state. Economic impact models often are used to determine the economic development that would occur from a change in gross sales of fisheries products from such activities as an increase in catch or change in market price. These economic impact models approximate the local economies by expressing economic relationships among business sectors of the economy. In 1986 this new, analytical procedure was applied to the state's fishery enhancement program to aid in the planning and budgeting processes. This was a first-of-its-kind project analysis of resident employment resulting from the state's investments in salmon ranching. The model was designed and contracted through a cooperative effort with ISER.

Results of studies conducted on the fishery enhancement program project large personal income and employment impacts from the state-owned hatchery program. In 1987 the FRED Division began coordinating a new and greatly enhanced phase of the fishery enhancement impact analysis. The impact data collection and modeling effort has included the biological, fishery, and economic analyses of over 200 state enhancement projects, including the recreational fishery component and the PNP Hatchery Program component. This analysis has involved a multiagency data collection effort with FRED staff and the PNP Program, the Department of Commerce and Economic Development revolving loan fund office, the ADF&G, Sport Fish Division, and ISER.

Improvements in the 1987 FRED impact model have allowed for a more precise estimate of direct impacts to the commercial fishery and processing sector of the Alaskan economy. The FY 89 budget impacts for FRED Division result in approximately \$35 million in personal resident income to Alaskans and over 1,000 jobs. The analysis of PNP Program impacts that result from brood year 1988 are preliminary at this time. The preliminary estimates project approximately \$40 million in personal income and 1,100 resident Alaskan jobs. The additional personal income impacts of

recreational fishery projects were completed early in 1988 and were found to produce approximately \$4.3 million and 170 resident jobs.

During 1989 a revision of the economic impact studies was initiated for the FY 91 budget cycle. This update includes a survey of PNP and state hatchery operations, projected salmon harvests, and fiscal expenditures. The study results will be complete in early 1990.

Information Services

During 1989 FRED Division added to its information management personnel by hiring a new research/analyst for each of the two FRED Division regional offices and a new analyst/programmer for the Coded-Wire Tag Processing Laboratory, in addition to an existing staff consisting of: A research analyst in Headquarters and an analyst/programmer at the Coded-Wire Tag Processing Laboratory. The research/analysts have become the information brokers for their respective regions and are responsible for, among other things, collecting, compiling, editing, and disseminating much of the FRED Division's production information. They provide reports, graphics, and various data about FRED Division to public and private organizations and individuals around the world.

The research/analysts also have fundamental roles in most of the divisional software planning and development. Two major databases underwent development in 1989. One, termed "CHAMP," is a tool for hatchery managers and is intended to aid in tracking hatchery production. The other database is a planning tool intended to aid in managing future hatchery production. Other databases, such as a database cataloging fishery contributions, also are in the process of being developed.

The new programmer at the Coded-Wire Tag Processing Laboratory is funded through the Oil Spill Impact and Restoration Division and works on various projects concerning the Prince William Sound Exxon Valdez oil spill. He has been programming assorted reports on Prince William Sound stock assessment, as well as helping to maintain the comprehensive 14-year coded-wire tag database. He currently is assessing methods for making the historical database available in a personal computer environment so that the data can be readily accessed by biologists and researchers.

Strategic Planning and Public Participation

During 1989 the FRED Division drafted the first divisional strategic plan to be developed by an ADF&G fisheries division. The division Senior Management Team (SMT) was led by Director Brian Allee in structuring an orderly and ongoing process of strategic planning to address FRED's future development and to involve the public in that process.

The SMT produced a "Working Outline," based upon a mission and roles that had been identified and defined by the SMT in 1987.

After analyzing the environment in which it must function, the division developed strategies to be the basis for action plans, objectives, and goals. But, realizing that the

ultimate decision-making responsibility for plan development must be shared with a broad-based FRED staff, the SMT delegated further development of the plan to an Action Planning Team (APT) that includes representatives of scientific disciplines and regional line staff.

While the SMT maintains an oversight role on the process and products, the APT is planning activities to implement strategies, reviewing problems and opportunities previously identified, and constructing objective statements. In February 1990, the SMT and the APT will meet jointly to assess the long-term impact of plan objectives and to agree on division goals.

To keep the Alaska aquaculture community and the general public aware of planning activities and the products of the division, meetings have been scheduled in the various regions of the state. These meetings, advertised widely in the media, will have been scheduled in each generally recognized geographic region by mid-April 1990. Their content not only includes discussion of the strategic planning process but also statewide and region-specific overviews of FRED activities. A draft plan will be provided for various levels of division, department, and public review during March 1990.

While providing the public opportunity to review the planning process and its products, the FRED Division also has concentrated on other public-participation activities which will provide interested parties more involvement in project decision making.

Opportunity for public comment has been scheduled for such projects as Turner Lake, Baranof Warm Spring, and Amalga Harbor. The SMT has adopted a "Citizen Participation Program" that commits the division ". . . to improving the methods by which the public becomes involved in project and program planning." This process should be implemented division-wide by the close of calendar year 1990.

Public Education

FRED Division personnel make many technical presentations and produce many technical publications (see appropriate sections of this report), but FRED also is involved in many public educational opportunities for the people living in and visiting the State of Alaska. As many as a quarter of a million people have visited FRED Division hatcheries annually for the past several years. Many of these visitors are classes of school children and local residents. Numerous tours of facilities have been hosted, including visits to the Broodstock Development Center and the Big Lake, Clear, Crystal Lake, Deer Mountain, Fort Richardson, Gulkana, Klawock, Snettisham, and Sikusuilag Springs Hatcheries.

FRED personnel across the state are providing unique, aquatic resource educational opportunities for local school districts by assisting teachers with a variety of materials to demonstrate various aspects of salmon life history, development, and biology. FRED personnel have taught educational units in Anchorage, Palmer, Wasilla, Cordova, Homer, Fairbanks, Kodiak, and Glennallen. Several individuals have made special efforts to supply technical expertise and materials to establish self-contained incubation units in schools. Students in Anchorage, Palmer, Wasilla, Fairbanks, Tok, Ketchikan, and Skagway have had the opportunity for hands-on experience in applied aquatic biology to develop a sense of "ownership" and personal involvement as they observe and

care for developing salmon. In addition, FRED Division is working directly with a local legislator, the Anchorage School District, and the Municipality of Anchorage to promote a cooperative program to integrate aquatic resource education and habitat restoration into student activities.

Engineering Services

Engineering services provided by FRED Division staff consisted of consulting, design, contract, drafting design, and project management, both within and outside the division.

Within the FRED Division, the following work was accomplished during 1989:

- ° Pillar Creek Hatchery - Incubation building design and purchase. Development of a water well to supplement the water supply for the incubation building.
- ° Kitoi Bay Hatchery - Design and construction of a new incubation building and aluminum raceways.
- ° Trail Lakes Hatchery - Handicap access design and construction documents were completed.
- ° Fort Richardson Hatchery - Design and construction of a handicap-access restroom in the new egg-take building were completed.
- ° Tutka Bay Hatchery - Design and installation of snow deflectors for the roofs of the hatchery buildings.
- ° Clear Hatchery - Design and construction of aluminum raceways.
- ° Crystal Lake Hatchery - Design and construction of an addition to intake structure.
- ° Klawock Hatchery - Design and construction for the renovation of the sewage-treatment system.
- ° Snettisham CIF - A schematic design was completed.
- ° Elmendorf Hatchery - Design of the standby generator facility was completed.
- ° Snettisham Hatchery - Design and installation of a fire pump for a sprinkler system in the bunkhouse was completed.
- ° Sikusuilag Springs Hatchery - Consulting engineer's schematic design of the proposed expansion was reviewed.

Drafting Support:

- ° Proposed Baranof Warm Spring Hatchery.
- ° Contract for conceptual plan cost estimate was prepared.

Outside the FRED Division the following projects were completed in cooperation with and under contract with other divisions within ADF&G:

- Proposed design for King Salmon dormitory renovation.
- Design and construction of Potter Marsh boardwalk and parking area.
- Soldotna Cabin - Design of a sewer system.
- Chignik - Revised the sewer system design and provided "as built" to the Department of Environmental Conservation.
- Cordova 8-Unit Sleeper - Prepared "as built" for Fire Marshall review and approval.
- Tok office roof and electrical upgrade completed.
- Fairbanks Office - Construction of parking for handicap access completed.
- Review of plans for habitat requirements.

TECHNOLOGY AND DEVELOPMENT

With the advent of earnest discussion of fish genetics and department policy on fish genetics in the context of (a) setting aside watersheds selected as genetic reserves, and (b) the pros and cons of finfish mariculture in Alaska, the Chief of Technology and Development teamed up with the Principal Geneticist to write a report that explains the underpinnings of the department's fish genetics policy. The report has been completed and many requests for copies have come in. The authors hope that this effort will foster better understanding of the genetic policy and the manner in which it is applied. On the subject of genetics, our Principal Geneticist, Dr. Bob Davis, will be retiring at the end of February and recruitment is underway to find a replacement.

The FRED Division is continuing to take the lead in the search for and development of a "mass mark" for juvenile salmon released from hatcheries. Elsewhere in this report, work in progress in the division's Southeast Region is presented that explains the placement of thermal marks on the otoliths of sockeye salmon. The division intends to find a new home for its Coded-Wire Tag Processing Laboratory and expand the lab's capability to include otolith processing.

During the past year, a cooperative project on chemical mass marking was undertaken with the National Marine Fisheries Service (NMFS), Auke Bay Laboratory. The project involved the use of new instrumentation recently available at the Auke Bay Laboratory that would detect the presence of very small amounts of oxytetracycline, an antibiotic commonly used in fish culture. This approach reached a dead-end when it was discovered that the instrumentation could not detect very small amounts of the compound. Other avenues for use of chemical markers are being pursued. At this time, however, biological markers appear most promising.

Technology and Development employees were extensively involved with impact analyses of the Prince William Sound oil spill. The Coded-Wire Tag Processing Laboratory is processing tags from Prince William Sound pink salmon as part of an overall effort aimed at assessing marine survival of pink salmon in the Sound. The Limnology Laboratory is processing plankton samples and the Pathology Laboratory is warehousing samples for possible future histopathological analyses.

The Chief of Technology and Development traveled to the Soviet Far East to participate in a salmon symposium held at Yuzhuo-Sahkalinsk on Sahkalin Island. This island is north of the Japanese Island of Hokkaido and is the area where the Soviet's pink and chum salmon hatcheries are located. Soviet salmon culture is technologically constrained but, nevertheless, the Soviet program is large, ranking third behind Japan and Alaska.

Coded-Wire Tag Processing Laboratory

1989 was a record-setting year at the Coded-Wire Tag Processing Laboratory. Laboratory staff processed 40,000 heads recovered by sampling programs throughout the state. This surpassed the laboratory's previous record by 5,000 heads. During each of four weeks this summer, staff processed more heads than during any single week in their eight previous years of operation. During the second week of July, 3,400 heads were received and processed. Even during these peak weeks, laboratory staff were able to

process all heads recovered from commercial and sport sampling sources within a week of receipt.

Although the majority of work continues to be generated by sampling programs in southeast Alaska, the rest of the state contributed 30% of the workload this year, as compared to 19% in 1988. Production figures do not include 900 smolts processed for cooperative projects between FRED Division and the U.S. Forest Service. The species and sample-source composition of the laboratory's workload is illustrated in Table 5.

Table 5. Coded-Wire Tag Processing Laboratory sample-source composition by species.

	Commercial	Cost recovery	Sport	Rack and escapement	Other	Total
Chinook	7,420	480	840	3,080	170	11,990
Chum	1,100	1,060	0	540	40	2,740
Coho	9,730	1,200	910	3,600	0	15,440
Pink	4,680	2,520	0	920	0	8,120
Sockeye	1,280	0	0	370	0	1,650
Steelhead	<u>30</u>	<u>0</u>	<u>30</u>	<u>0</u>	<u>0</u>	<u>60</u>
TOTAL	24,240	5,260	1,780	8,510	210	40,000

Nearly 10,000 heads were received from Prince William Sound sampling programs conducted as part of the state's efforts to assess the impact of the Exxon Valdez oil spill on salmon fisheries in the Sound. Pink salmon tagged and released during the spring of 1988 were recovered in the Sound's fisheries during the summer of 1989. An additional crew of one permanent full-time analyst/programmer and seven full- and part-time seasonal technicians were hired to process this additional work. Despite employment of a new crew not hired until well into the season, laboratory staff were able to process these heads within the same time frame as all other samples received at the laboratory. Programs were written to distribute data weekly to Cordova in the format required for fishery management and for oil spill impact assessment evaluation. In addition, the laboratory also processed coded-wire tag samples from all projects assessing early marine salmon injury in Prince William Sound. These 600 samples were processed using chain-of-custody and special processing procedures to ensure that the fish were not contaminated during tag removal.

Fishery managers responsible for managing chinook and coho salmon fisheries in southeast Alaska were able to use coded-wire tag data, including hatchery contribution, to assist them in managing their fisheries. Although Alaska's hatchery contribution to chinook salmon fisheries in southeast Alaska was well below the preseason forecast, fishery managers still were able to take inseason advantage of the hatchery add-on clause of the U.S./Canada Pacific Salmon Treaty. During the 1989 fishery accounting year (1 October 1988-30 September 1989), Alaskan hatcheries contributed 24,700 chinook salmon (8.7% of the catch) to the commercial and sport harvests in southeast Alaska. This estimate is reduced by 5,000 fish (base hatchery harvest) and by 2,000 fish (estimated error-risk adjustment) resulting in a catch ceiling of 283,700 chinook salmon.

For the first time, Southeast coho salmon fishery managers expressed a need for inseason coho salmon tag data. This need was consistently met.

The laboratory continued to meet the growing data needs of its users. Staff continued to make improvements to existing reports and create new production and special purpose reports to meet data needs not addressed in existing reports. All 1980-1988 data transmitted coastal-wide through the Pacific Salmon Commission's database passed a very rigorous validation. Additional information about the release of tagged fish in Alaska was added to many of the 2,500 release records on file.

The laboratory continued to send letters to all commercial and sport fishermen who caught marked fish. These letters to 1,200 commercial fishermen and 950 sport fishermen list the hatchery and other release data about each tagged fish caught.

Major changes to the database were made this year to accommodate a need of fishery managers to distinguish catch, sample, and tag recoveries by harvest type. These changes were coordinated between analyst/programmers responsible for the department's major databases; the coded-wire tag database, fish ticket database, and the Southeast Region's inseason commercial catch reporting system division in Southeast. Data collection forms and instructions, data entry programs, data analysis, and reporting programs were rewritten prior to the start of the summer troll season to accommodate these required improvements to fisheries data.

Limnology/Lake Fertilization

Water Quality:

The Limnology Laboratory supports FRED Division's lake fertilization and lake stocking programs as well as those of cooperative state, federal, and private agencies listed below.

Alaska Department of Fish and Game

Commercial Fisheries Division. Juneau.
Wildlife Conservation Division. Soldotna.
Beaver Falls Hatchery. Ketchikan.
Big Lake Hatchery. Big Lake.
Crooked Creek Hatchery. Kasilof.
Deer Mountain Hatchery. Ketchikan.
Elmendorf Hatchery. Anchorage.

Private Nonprofit Hatchery Groups

Cook Inlet Aquaculture Association. Soldotna.
Kodiak Regional Aquaculture Association. Kodiak.
Lower Cook Inlet Seiner's Association. Homer.
Northern Southeast Regional Aquaculture Association. Sitka.
Prince William Sound Aquaculture Corporation. Cordova.
Southern Southeast Regional Aquaculture Association. Ketchikan.

Federal Government Agencies

National Marine Fisheries Service.
National Park Service.
U.S. Fish and Wildlife Service. Soldotna.
U.S. Forest Service. Anchorage/Sitka/Ketchikan.
U.S./Canada Pacific Salmon Treaty.

Other

Kenai River Water-Quality Cooperative Study. Alaska Department of Natural Resources. Soldotna.
University of Alaska. Fairbanks. (Sea Grant).
Oregon State University. Corvallis, Oregon.

The Limnology Section has centralized laboratory facilities in Soldotna, and both water-quality and zooplankton samples are sent here from projects located throughout the state.

During 1989, the Limnology Laboratory conducted over 23,000 individual water-quality tests and zooplankton analyses from 68 lakes statewide. In addition, baseline water-quality samples were processed from six existing hatcheries and from two potential hatchery sites (i.e., Pillar Creek on Kodiak Island and Salmon Lake near Nome). Contracts for low-level nutrient analysis have again been initiated with Oregon State University and the University of Alaska-Fairbanks. Samples from Oregon State University were collected from various caldera (active) lakes within the Aniakchak National Monument, whereas the University of Alaska-Fairbank's samples were collected from several Interior streams. Additional funding (FY 90) for these two projects is anticipated at ~\$1,500 and \$2,700, respectively.

Finally, we have successfully analyzed preliminary "test" samples of moose serum and urine for urea nitrogen. Although no contract has been established, the ADF&G, Division of Wildlife Conservation (Soldotna) has expressed interest in utilizing any future services of the Limnology Laboratory on a cost-per-sample basis. In addition, laboratory staff provided nitrogen analysis of several "solid-waste" samples collected from the settling tank from Trail Lakes Hatchery. The analytical results were used to determine the appropriate disposal method of such waste material as per Alaska Department of Environmental Conservation regulations. Quality assurance for laboratory analyses was maintained by the 1988 U.S. Geological Survey Water Reference Program.

We have just completed the 1989 quality-assurance samples and have begun analyzing this year's nutrient samples. Currently, one Limnologist I, one Fishery Biologist I, and one Fish and Wildlife Technician III are processing water-quality samples. We anticipate completing all nutrient, chl *a*, and carbon samples over the winter. Water-quality data reports will be disseminated to the various project leaders on a priority basis.

Marine Nearshore and Freshwater Zooplankton:

In addition to the processing of freshwater samples, John Edmundson and Pat Shields have been analyzing marine phytoplankton, epibenthic, and fish stomach samples under

contract with both state and federal agencies as part of the Exxon Valdez oil spill assessment.

Regarding the marine samples, it should be noted that laboratory staff have completed the NMFS work which was contract awarded to the laboratory. All contractual obligations have been met and the data have been forwarded to the lab at Auke Bay. Staff are nearing completion of the National Park Service inventory and will begin on samples on-hand from ADF&G. Jim Raymond, the area biologist responsible for collecting the ADF&G marine samples, has informed laboratory staff that more samples are forthcoming. Over 500 samples have been received and all contracts are proceeding on schedule. As John and Pat are utilizing their full resources to process marine samples, the laboratory now has only one Fish and Wildlife Technician III analyzing this year's inventory of over 700 freshwater zooplankton samples. Acquisition of automated image-analysis equipment to facilitate processing of biological samples is pending upon necessary funding from additional oil spill-related projects.

To date the Limnology Laboratory is equipped with four PCs installed with various database management, statistical, and word-processing software. The water-quality database contains over 70 lakes and is continually being updated. To facilitate data management, staff are developing a new program to automatically transfer raw analytical results (tests) into the appropriate files. The zooplankton database (density + biomass) contains information from over 80 lakes.

Regarding laboratory health and safety, the laboratory has installed an air-ventilation system, as recommended by both the Alaska Departments of Environmental Conservation and Labor. In addition, waste-disposal practices have been improved, despite the laboratory's prior and current status as a "conditionally exempt small quantity waste generator." Specifically, liquid wastes will not be discharged directly from the lab but will be stored in secured containers and shipped to an appropriate waste-disposal site.

Field Projects:

Northern Southeast. Applied limnology and fisheries field research was conducted on Auke, Chilkat, Chilkoot, Crescent, Mountain, Situk, Speel, Sweetheart, and Turner Lakes as a continuation of the division's sockeye salmon enhancement and rehabilitation program. These projects were designed to (1) identify barriered lakes suitable for enhancement by stocking juveniles and for nutrient enrichment, and (2) continue rearing-capacity studies to identify rehabilitation and management options for increasing indigenous sockeye salmon populations. In support of these projects, a total of 44 limnological and 11 hydroacoustic surveys were completed. In addition, bathymetric maps were constructed for Mountain, Situk, Speel, Sweetheart, and Deer Lakes and, as a part of the laboratory's diet study program, a total of 180 sockeye salmon and stickleback stomachs were analyzed from fish rearing in Chilkoot and Chilkat Lakes.

Funding for these projects continues as highly cooperative ventures through the Northern Southeast Regional Aquaculture Association, the U.S. Forest Service (Sitka Ranger District), the ADF&G, Commercial Fisheries Division, and the U.S./Canada Pacific Salmon Treaty.

Southern Southeast. Applied limnology and fisheries field research was conducted on 12 projects involving 20 lakes during 1989 to evaluate juvenile sockeye salmon outplants, lake enrichment, and to assess sockeye salmon production potential. McDonald Lake (nutrient enrichment) produced 156,930 adult sockeye salmon of which the commercial

seine and drift gillnet fleets in fishing districts 101-108 caught 89,319. This represents 8% of the total sockeye salmon harvest in southern Southeast and was valued at over \$1,000,000. Personal-use fishermen harvested an additional 5,000 adults, and a special 36-hour experimental seine fishery in Yes Bay netted 5,500 sockeye salmon valued at \$60,000. A late fall hydroacoustic survey of Virginia Lake (juvenile outplants) showed excellent survival of juvenile sockeye salmon planted there in the spring of the same year. Additional evaluation of sockeye salmon juvenile outplants continues at Bakewell/Badger Lakes which is expected to produce nearly 40,000 adult sockeye salmon, at Margaret Lake, and at Salmon Lake on the Karta River. Further activities involve the assessment of water quality at the Hyder coho salmon rearing ponds, sockeye salmon production at Woodpecker Lake, and project feasibility assessments at Orchard, Eagle, and Ward Lakes.

In support of these projects, a total of 31 limnological and 14 hydroacoustic surveys were completed. In addition, bathymetric maps were constructed for four lakes, including Orchard and Eagle Lakes, and sockeye salmon smolts were coded-wire-tagged at the Naha River.

Funding for these projects continues as highly cooperative ventures with the U.S. Forest Service, involving the Ketchikan, Stikine, and Misty Fjords Ranger Districts, as well as the Southern Southeast Regional Aquaculture Association.

Southcentral. Applied limnology and fisheries field research was conducted at Chenik, Afognak, Akalura, Karluk, Frazer, Packers, Leisure, Hidden, Tustumena, Paint River, and Skilak Lakes to evaluate juvenile outplants, nutrient enrichment, and to assess sockeye salmon production potentials. In support of these projects, over 24 limnological and 12 hydroacoustic surveys were completed. A new project recently implemented was a water-quality study of the entire length of the Kenai River. This is a multi-agency project involving the Alaska Department of Natural Resources, the U.S. Fish and Wildlife Service, and the ADF&G, FRED Division. The Kenai River Advisory Board formally accepted the Kenai River Water-Quality Database Acquisition Plan on 26 October 1989, and the plan was subsequently reviewed by the Cook Inlet Regional Planning Team. Funding for the project is part of a CIP appropriation to the Department of Natural Resources, Division of Parks and Outdoor Recreation and is anticipated to last for two years.

Funding for these projects continues as highly cooperative ventures with the Kodiak Regional Aquaculture Association, the Cook Inlet Aquaculture Association, the English Bay Native Corporation, the U.S. Fish and Wildlife Service, and the U.S. Forest Service Anchorage Ranger District.

Technology Transfer:

Limnology staff are members of several committees involved in transferring information gained from applied research projects, such as those outlined above. For example, limnology staff serve on two Masters of Science thesis committees at the University of Alaska and are part of the Enhancement Subcommittee of the Transboundary River Technical Team for the U.S./Canada Pacific Salmon Treaty. Also, limnology staff are part of the Strategic Planning Team for the FRED Division, and one staff member serves as a co-principal investigator of a Sea Grant-funded project out of the University of Alaska. Finally, the Limnology Laboratory hosted a visit from Dr. Victor Bugaev of the Soviet Union. Dr. Bugaev toured the laboratory and went on a hydroacoustic survey on Tustumena Lake, a sockeye salmon nursery lake. Dave Barto, Dive Master for

ADF&G, organized a week-long workshop for department divers. The workshop was held in Juneau on 23-27 October and emphasized safety procedures and techniques that prevent dive accidents.

Pathology

During 1989 pathology staff inspected a total of 44 hatchery facilities out of a total of 48. Four facilities were not inspected either due to a lack of or very minor fish culture activities at those sites. The two pathology laboratories processed a total of 211 cases with a total of 26,743 tests performed: 8,139 at the Anchorage laboratory, 18,157 in the Juneau laboratory, and 447 were worked on by both laboratories. Capabilities of the pathology laboratories include expertise in virology, bacteriology, immunological assay procedures, histology, and transmission electron microscopy. Additional activities included review of 141 Fish and Shellfish Transport Permits (98 for Southeast and 43 for Southcentral) with a total of 131 approved.

Papers published either in the FRED Division Technical Report Series or in peer-reviewed scientific journals were six in number. A FRED Special Report included updated and new fish pathology regulations that were approved by the Alaska Board of Fisheries and will be approved shortly by the Attorney General's Office.

In FY 89 the infectious hematopoietic necrosis virus (IHNV) monitoring program encompassed 3,254 tests or titrations to determine IHNV prevalences and titers. These data mostly included routine monitoring of sockeye salmon broodstocks for hatchery use and assessment of IHNV risk management. Data generated have produced a huge database that is used to examine IHNV kinetics within sockeye salmon populations, the conclusions from which are now in press for publication. IHNV losses of sockeye salmon fry within the incubators this past year have been very minimal; i.e., one million in two incubators at the Gulkana facility. Two small experimental groups of brood year 1988 sockeye salmon reared to fingerling size at the Big Lake Hatchery were destroyed due to IHNV, possibly originating from the creek water supply. Production fish are reared on IHNV-free well water.

Future information to be gained by continuing broodstock monitoring of all sockeye salmon stocks is minimal and, at best, is only useful in hindsight rather than being predictive in nature. Three years of such effort has shown that high prevalences of high-titered parents often result in vertical transmission of the virus and IHN outbreaks in a few incubators when 20-30 million eggs are taken. All stocks of anadromous sockeye salmon carry the IHN virus and any prevalence is a risk which has been adequately mitigated or controlled by FRED Division sockeye salmon policy procedures. It is time to refocus some of the IHNV monitoring effort towards supporting specific new FRED Division sockeye salmon smolt projects at Main Bay and Kitoi Bay Hatcheries and at the Southern Southeast Regional Aquaculture Association's sockeye salmon project. These areas are indeed new ground and at the cutting edge of sockeye salmon culture technology.

The enzyme-linked immunoabsorbent assay (ELISA) has been successfully tested and established at the Juneau Fish Pathology Laboratory as a routine method for detecting *Renibacterium salmoninarum*, the agent for bacterial kidney disease (BKD). ELISA is extremely sensitive and consistent in marking positive fish and has shown the considerable inaccuracy of the previous fluorescent antibody test (FAT) for screening purposes. All kidneys from Southeast salmonid stocks tested with FAT in FY 89 (over 5,000) were

again examined with ELISA for comparative purposes. This work has generated a huge database which will be analyzed for the benefit of statewide control of BKD, disease history information, and publication purposes. However, no technique is without some negative tradeoffs, which for ELISA include: (1) increased expense for the reagents (excluding the initial capital outlay); (2) more labor-intensive to prepare the samples; (3) the test must be done in the laboratory; and (4) hatchery personnel collecting the samples must be scrupulous to avoid cross-contamination due to the sensitivity of the assay. These are minor disadvantages when considering the near absolute capability of the test and its widespread acceptance as state-of-the-art in the scientific community. Many Southcentral stocks will be examined next year using ELISA.

The Juneau pathology staff conducted a week-long fish health laboratory shortcourse at the University of Alaska-Southeast for two consecutive weeks to accommodate state, federal, and private nonprofit hatchery staff from nearly every facility in the state. Participants learned to perform basic laboratory necropsy procedures and identify abnormalities as a first line of defense against disease problems at the hatchery. A tour of the Juneau laboratory was given to each group with demonstrations of ELISA, transmission electron microscopy, virology, and FAT capabilities. Eight-by-ten photographs of IHN virus particles from a Southeast sockeye salmon stock were taken on the Juneau electron microscope and distributed to those facilities involved in sockeye salmon culture. Feedback from participants indicated this course was well received.

Surveys of the distribution of the bitter crab dinoflagellate parasite continue in Southeast *bairdi* Tanner crab populations and has extended to the *opilio* crab fishery in the Bering Sea with the discovery of this parasite in that area last year. The problem is very serious in Southeast and could become so in the multimillion dollar Bering Sea crab fishery. Current needs are management strategy regarding earlier harvest seasons due to the seasonality of the disease and education of the fishermen on proper disposal of infected crabs. Industry, ADF&G, NMFS, and university efforts are involved.

The FRED Pathology Program has been striving to provide Alaskan oyster growers with a competitive list of disease-certified broodstock sources for the Japanese oyster in the Pacific Northwest. Certified sources for *Crassostrea gigas* spat now include five facilities and possibly two more that are in progress regarding examination. The two most recent vendors to be included are Coast Oyster and Kuiper Mariculture, Inc., both of which are the two largest spat producers on the West Coast. The latter facility is unique in that the spat for Alaskan growers has originated from an Alaskan stock sent to Oregon and spawned there at a support facility. The larvae were then transferred to the Kuiper facility in Humboldt Bay, California where they were set as spat. There is absolutely no shortage now of spat available to Alaskan oyster growers.

The Principal Pathologist of the FRED Division Fish Health Program was appointed by the Oil Spill Impact Assessment and Restoration (OSIAR) Management Team as chairperson of the Histopathology Technical Group charged with developing procedures for proper collection of animal tissues for histological processing in the assessment studies of the Exxon Valdez oil spill. The committee was composed of five people representing NMFS and the U.S. Fish and Wildlife Service, in addition to ADF&G. Procedures were developed and implemented along with quality control and chain-of-custody guidelines. A secure space for a repository to allow storage and cataloging of all tissue samples collected for histology has been acquired in Anchorage. An Anchorage pathology staff member has been temporarily assigned to maintain the repository. Tissues will be selected from the repository by respective project investigators and sent to approved contractors for processing and interpretation in support of assessment studies.

Replacement of the Salmon Creek Bridge and reconstruction of the nearby intersection required a grade change in front of the Juneau Fish Pathology Laboratory. This involved a new, raised driveway in front of the laboratory and construction of a gravel parking lot to the left side of the building. The finished results look aesthetically pleasing and appear functional.

Genetics

In 1989 the genetic program continued to focus work on the Genetic Policy, review of Fish Transport Permits, and review of Private Nonprofit Hatchery Permits and alternation requests. There was, however, increased emphasis on involvement in project development and review of existing enhancement programs for possible genetic consequences. At the Fort Richardson Hatchery, Broodstock Development Center (BDC), work continues on the genetic improvement of the rainbow trout broodstock.

Genetic selection was initiated in 1986 on the Swanson River rainbow trout broodstock at the Fort Richardson Hatchery, BDC. The goal of this project is to develop a strain of rainbow trout that has high survival and fast growth, both in the hatchery environment and in waters where they are stocked. Selection also is being applied to shift spawning time from early May to early March. In spring 1989, the first select family lots were produced from select adults. Performance of these progeny, after they are released, will provide preliminary evaluation of the selection program. Survival and growth performance of the Swanson River select lots will be compared with performance of nonselect Swanson River and Big Lake lots.

Experiments initiated in 1988 to develop an all-female population of rainbow trout were continued in 1989. Methods reported in the literature are being adapted for use at the Fort Richardson Hatchery. There are two basic steps in the procedure: (1) The sex reversal and isolation of genetic females; and (2) when the phenotypic males, produced by the sex reversal of females, are mated to normal females, they will produce 100% female progeny.

Experiments in the development of triploid (sterile) trout continued in 1989. The 1988 experiments indicated limited results. In 1989 the project was slightly modified and preliminary results appear more successful. Sexual maturation results in increased mortality, slowing of growth, and reduction of flesh quality. This may be thought of as a necessary economic burden, but in some cases this burden will be eliminated by stocking all-female triploid trout.

Fisheries Library

During 1989 the Fisheries Library continued to operate with financial support from the ADF&G, FRED, Commercial Fisheries, and Sport Fish Divisions. The FY 90 funding level of \$79.3 was distributed between the aforementioned divisions based on respective usage figures from FY 89. Library staff are still inputting the individual request figures for the past five months and will soon have graphs available which show the 1989 calendar-year usage statistics by division.

It is anticipated that the overall usage figures will be similar to those of 1988 because any significant increase due to the oil spill will, most likely, be offset by diminished circulation of "current awareness" materials. This has been a difficult year with the

hiring and training of two Library Assistants and having a four-month period during which the position was vacant. However, the library staff is steadily gaining ground and hope to clear any backlog by the end of January 1990.

Throughout the year the Fisheries Library's "current awareness" database and online catalog continued to expand. Because of this growth, a 10-mb hard drive was saturated and required the purchase of a 30-mb drive. Staff have need of additional equipment that would enhance the library's services to the fisheries divisions of ADF&G. The Fisheries Library currently has a microfiche/film reader-printer that has gone from marginal copy quality to very poor and, in many cases, cannot even produce a readable page. This situation is compounded by the fact that a growing number of the documents received through interlibrary loan or for permanent inclusion in the collection are on microfiche. While publication of information in microfiche format is appropriate, considering storage limitations and lower circulation costs, it is nonetheless imperative that the Fisheries Library have the ability to create paper copies from microfiche. Efforts are underway to replace the old equipment.

Formal Technical Presentations

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Barto, D. 1989. Lake fertilization projects in Southeast. 1989 Sockeye Salmon Workshop, 11-12 July, Soldotna, Alaska.

Bechtol, W. 1989. Juvenile sockeye salmon (*Oncorhynchus nerka*) foraging at high densities on autochthonous prey. Annual Meeting, American Fisheries Society, 4-8 September, Anchorage, Alaska.

Brock, I. and C. Olito. 1988. Preliminary results of producing all female and triploid rainbow trout. Northwest Fish Culture Conference, December, Vancouver, B.C., Canada.

Burkett, R., D. Amend, J. Koenings, K. Roberson, and L. White. 1989. A decade of sockeye salmon enhancement and rehabilitation in Alaska: strategies and results. Annual Meeting, American Fisheries Society, 4-8 September, Anchorage, Alaska.

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THE PRIVATE NONPROFIT HATCHERY PROGRAM

Background

The 1974 Alaska State Legislature authorized the Commissioner of ADF&G to issue permits to private nonprofit (PNP) corporations for the operation of salmon hatcheries for ocean ranching. The intent of the program was to allow private ownership of salmon hatcheries that would contribute to the state's salmon fisheries. The cost of constructing and operating these hatcheries was to be derived from the sale of a portion of the returning fish.

The PNP Program, administered by the ADF&G, FRED Division, in cooperation with the department's fisheries management divisions, carries out the statutory and regulatory responsibilities pertaining to public and private aquaculture in Alaska.

The PNP Program is responsible for:

- ° comprehensive salmon production planning;
- ° administration of the permitting process for PNP salmon hatcheries and scientific/educational aquaculture programs;
- ° development of annual operations management plans for all public and private salmon hatcheries;
- ° administration and coordination of the statewide fish and shellfish transport permit systems;
- ° coordination of technical assistance to PNP hatcheries;
- ° coordinating the development of and ADF&G relations with qualified regional aquaculture associations; and
- ° administration and coordination of the U.S./Canada fisheries enhancement program.

Regional Associations

Regional associations are comprised of representatives of commercial fishermen and other user groups in the region, including sport fishermen, subsistence fishermen, and members of local communities. Seven regional associations have been formed:

1. Southern Southeast Regional Aquaculture Association (SSRAA)
2. Northern Southeast Regional Aquaculture Association (NSRAA)
3. Prince William Sound Aquaculture Corporation (PWSAC)
4. Cook Inlet Aquaculture Association (CIAA)

5. Lower Yukon/Kuskokwim Regional Aquaculture Association (LY/KRAA)*
6. Bristol Bay Regional Aquaculture Association (BBRAA)
7. Kodiak Regional Aquaculture Association (KRAA)

These associations cooperate with the department in developing and maintaining regional salmon production plans and in the implementation of various salmon rehabilitation and enhancement activities.

Comprehensive Salmon Planning

The 1976 law authorized the Commissioner of ADF&G to designate regions of the state for the purpose of enhancing salmon production. This same law also established the formation of regional planning teams (RPT) to develop regional salmon plans. Each RPT consists of six voting members, with three department personnel appointed by the Commissioner and three appointed by the board of directors of the appropriate regional aquaculture association. The duties and responsibilities of the RPTs have been mandated in a formal charter from the Commissioner. The responsibilities of the RPTs in developing regional comprehensive salmon plans, including provisions for public involvement in the planning process, are described in regulations. The Commissioner may also request the involvement of representatives of other federal and state agencies. The teams develop 20-year comprehensive plans, 5-year action (strategic plans), and perform annual plan update and maintenance.

The status of planning by region follows:

1. **Southern Southeast**

The southern Southeast regional plans have been approved, and the team is in the plan maintenance and update process.

2. **Northern Southeast**

The northern Southeast regional plans have been approved, and the team is in the plan maintenance and update process.

3. **Yakutat**

No formal salmon planning activities have occurred in Yakutat since approval of the 20-year regional plan. The plan has been accepted by the U.S. Forest Service as a basis for the development of land-management plans applicable to the region.

4. **Prince William Sound**

The Prince William Sound regional plans have been approved. The team has proceeded into the plan maintenance and update process.

* Indicates inactive regional association

5. **Cook Inlet**

The planning team efforts in Cook Inlet are presently directed toward watershed system planning, with a goal of assessing the capacity of specific systems to sustain and maintain significant, naturally occurring salmon stocks. Watershed system planning also includes an identification of opportunities for salmon enhancement techniques designed to strengthen existing runs and create new runs. Provisions for user-group access and harvest preferences are given primary consideration in this planning process.

6. **Kodiak**

The Kodiak regional plans have been approved and the RPT has proceeded into the plan-maintenance process.

7. **Bristol Bay**

The Bristol Bay RPT has completed the comprehensive salmon plan for Bristol Bay. The plan is unique in that, unlike plans for other salmon production regions in Alaska, it does not concentrate on fisheries enhancement through such strategies as hatcheries; rather, it emphasizes maintenance and restoration of fish habitat and effective management practices. The team has resumed active planning and is preparing a 5-year Action Plan, including projects for implementation.

8. **Lower Yukon/Kuskokwim**

No formal salmon planning activities are presently occurring in the lower Yukon/Kuskokwim region.

9. **Sikusilak Springs Hatchery Management Plan**

Residents of Kotzebue Sound are interested in salmon enhancement planning, and the FRED Division is developing a Basic Management Plan for the Sikusilak Springs Hatchery as a beginning for regional planning in the area.

10. **Alaska Peninsula Planning**

In 1990 a regional planning team will be appointed to begin salmon planning for the Alaska Peninsula.

PNP Hatchery Funding

Since 1977 funding necessary for the implementation of salmon rehabilitation and enhancement activities by PNP corporations has been obtained primarily through the Fisheries Enhancement Revolving Loan Fund administered by the Alaska Department of Commerce and Economic Development (DCED). The loan program has gone through several modifications by the Legislature, the most recent occurring in 1987. The maximal loan amount available for an individual project is \$10 million, with a payback period of up to 30 years at approximately a 9.5% interest rate. Payments and accrual of interest on these loans can be deferred for 6 to 10 years. Loans for projects not endorsed by the regional aquaculture association may also have these terms, except

these loans are limited to a maximum of \$1 million. Loans are available for the purpose of planning, construction, and operation of salmon rehabilitation and enhancement projects, primarily salmon hatcheries. These loans are secured through collateral that may include returning hatchery fish and enhancement assessments of commercial fishermen.

A cooperative agreement between ADF&G and DCED addresses an interagency/review and coordination process regarding PNP hatchery permit applications, the alteration of previously issued PNP hatchery permits, and loans related to PNP hatchery operations or other rehabilitation and enhancement activities.

Table 6 presents cumulative state loans secured by corporations for capital construction and operations, cumulative enhancement funds returned to the regional aquaculture associations, and revenue generated during 1988 by corporate sales of returning hatchery fish. Through 29 December 1989, \$68.2 million has been borrowed by PNP corporations. Another \$35.0 million has been generated through assessments. In 1989 PNP operators sold fish worth more than \$28.9 million. The majority of these funds (\$25.4 million) were generated from the sale of fish by the regional aquaculture associations in Prince William Sound and Kodiak because of restricted commercial fisheries resulting from the Prince William Sound oil spill.

Program Implementation

The application procedures and standards for issuance of PNP salmon hatchery permits are defined by regulations issued in 1985.

These regulations require the completion of a management feasibility analysis by ADF&G prior to the submission of a PNP hatchery application. This analysis must be completed within 30 days after the applicant provides the information requested in 5 AAC 40.130 of the regulations. The application process takes approximately 135 days and is designed to comply with the coastal zone consistency review process established by the Governor's Office of Management and Budget.

The appropriate RPT reviews each application and makes a recommendation to the Commissioner on the application's compatibility with the regional comprehensive plan. The RPT uses review criteria that are defined in the PNP regulations.

PNP permit holders may request alterations of their permits and basic management plans based on accumulated experience and changing conditions. The RPT may review and make a recommendation to the Commissioner on a permit alteration request. The team's review is conducted in accordance with performance standards identified in the PNP regulations.

Since the inception of the PNP Program, 29 salmon hatchery permits have been issued and three permits have been given up. Thirty-nine applications have been either denied or withdrawn from the process. The four most recent permits were issued to regional aquaculture associations for the operation of state-owned hatcheries in the Cook Inlet, Prince William Sound, Kodiak, and northern Southeast regions. The respective hatcheries involved were Trail Lakes, Cannery Creek, Kitoi Bay, and Hidden Falls.

Twenty-two of the permitted PNP hatcheries are in operation and 21 had returns of adult salmon during 1989. Currently, there are two applications for PNP hatchery

Table 6. Cumulative state loans and enhancement funds returned to associations (through December 29, 1989), and annual fish sales for 20 private nonprofit (PNP) hatcheries (through Dec. 31, 1989).

Region/Corporation (number of permits)	State	Loans	Cumulative Enhancement Funds Generated through Assessments, Returned to Associations via Contract	Estimated Revenue From 1989 Sales of Fish Returning to Special Harvest Areas
	For Capital Construction	For Operations		
SOUTHERN SOUTHEAST				
Southern Southeast Regional Aquaculture Association-SSRAA (3)	\$9,093,000.00	\$2,848,942.00	\$11,135,137.97 (note 1)	\$406,389.93
Alaska Aquaculture, Inc.-AAI (1)	\$1,053,285.00	\$2,103,208.00	N/A	\$173,167.79
Meyers Chuck Aquaculture Association-MCAA (1)	\$10,000.00	\$0.00	N/A	\$3,853.90
NORTHERN SOUTHEAST				
Northern Southeast Regional Aquaculture Association-NSRAA (3)	\$2,724,265.00	\$1,638,496.00	\$6,730,653.83 (note 1)	\$609,034.88
Armstrong-Keta, Inc.- AKI (1)	\$1,598,645.00	\$1,747,500.00	N/A	\$12,528.44
Burro Creek Farms, Inc.-BCF (1)	\$51,500.00	\$332,875.00	N/A	\$1,050.00
Douglas Island Pink and Chum Inc.-DIPAC (3)	\$7,984,000.00	\$2,902,000.00	N/A	\$37,991.00
Kake Nonprofit Fisheries Corp.-KNFC (1)	\$1,500,724.00	\$1,490,069.00	N/A	\$36,975.03
Sheldon Jackson College-SJC (1)	\$362,254.00	\$61,370.00	N/A	\$2,829.53
Tlingit and Haida Fisheries Development Corp.-THFDC (0)	\$1,464,000.00	\$89,860.00	N/A	
PRINCE WILLIAM SOUND				
Prince William Sound Aquaculture Corp.-PWSAC (3)	\$19,475,419.00	\$1,085,500.00	\$6,938,815.90 (note 2)	\$14,517,144.60
Valdez Fisheries Development Assoc.-VFDA (1)	\$3,193,830.00	\$3,250,543.00	N/A	\$1,988,963.00
COOK INLET				
Cook Inlet Regional Aquaculture Assoc.-CIAA (2)	\$1,438,881.00	\$683,369.00	\$7,868,440.13 (note 2)	\$269,528.05
KODIAK				
Kodiak Regional Aquaculture Assoc.-KRAA (1)	\$0.00	\$0.00	\$2,363,164.00 (note 2)	\$10,925,935.21
STATEWIDE TOTALS	\$49,949,803.00	\$18,233,732.00	\$35,036,211.83	\$28,985,391.36

note 1: 3% mandatory assessment tax collected from commercial fishermen.

note 2: 2% mandatory assessment tax collected from commercial fishermen.

permits under consideration. In addition, 38 scientific/educational permits for aquaculture research projects or school district aquaculture programs were issued in 1989 by the Commissioner. These permits are administered by the PNP Program.

Locations of operational PNP programs and remote release sites are illustrated in Figures 10, 11, and 12.

Hatchery Production

In 1989 PNP corporations estimated that 24.0 million adult salmon originally released as juveniles from corporate facilities were either harvested in common-property fisheries or returned to hatchery special harvest areas (Table 7). Not included in this figure are 7.6 million hatchery returns to the Kitoi Bay Hatchery that were already considered under FRED hatchery production elsewhere in the report. In Prince William Sound, returns to PNP hatcheries were estimated by the operators to have contributed over 12.4 million pink salmon to the commercial fishery. That contribution represents over 91% of the total harvest of pink salmon in Prince William Sound. SSRAA estimates its hatcheries at Neets Bay and Whitman Lake contributed over 401,000 chum, coho, and chinook salmon to the common-property fisheries in Southeast.

Statewide production data since 1975 for combined species, including adult returns and harvests, are presented in Table 8. Preliminary estimates by the PNP corporations indicate that common-property harvests of the 1989 return were over 13.1 million fish. This represents an increase from 1988 in common-property harvests due primarily to a large return of hatchery-produced pink salmon in Prince William Sound. Cumulative data for chum salmon produced by PNP corporations since 1975 are presented in Table 9. Similar data for sockeye, pink, coho, and chinook salmon are presented in Tables 10, 11, 12, and 13, respectively.

Egg takes and fry or smolt stocking are regulated by ADF&G through fish transport permits (FTP), which are administered by the PNP Program. During 1989 fry and smolt releases increased to 860 million juvenile fish, an increase of over 41 million (or 5%) from 1988 levels (Table 14). 1989 egg takes for PNP hatcheries totaled over 1.10 billion green eggs, up 63 million (or 6%) from 1988 levels. The largest egg take of 1989 was at Esther Lake Hatchery where over 330 million green pink, chum, coho, chinook, and sockeye salmon eggs were taken for incubation (Table 15). This was followed by PWSAC's Cannery Creek Hatchery with over 161 million pink salmon eggs, the Valdez Fisheries Development Association's (VFDA) Solomon Gulch Hatchery with over 151 million pink, chum, and coho salmon eggs, and PWSAC's Armin F. Koernig Hatchery with over 127 million pink salmon eggs. In total, more than 770 million salmon eggs were taken by PNP operators in Prince William Sound in 1989. In southeast Alaska, NSRAA took over 128 million pink, chum, coho, and chinook salmon eggs for its three hatcheries, SSRAA took over 52 million eggs of all five species for its three hatcheries, and Douglas Island Pink and Chum, Inc. took over 48 million pink, chum, and coho salmon eggs for its three facilities.

Significant progress was made in initiating hatchery-originated sockeye salmon production from PNP hatcheries. Releases of juvenile sockeye salmon totaled over 8.0 million in 1989. Sockeye salmon egg takes totaled 14.7 million eggs at PNP hatcheries in 1989. Significant increases in pink, chinook, and coho salmon production also were made in 1989. Pink salmon egg takes increased by 160 million over 1988 levels as the facilities in Prince William Sound came up to capacity. Coho, chinook, and sockeye salmon egg

Figure 10. Locations of operational PNP programs in southeast Alaska.

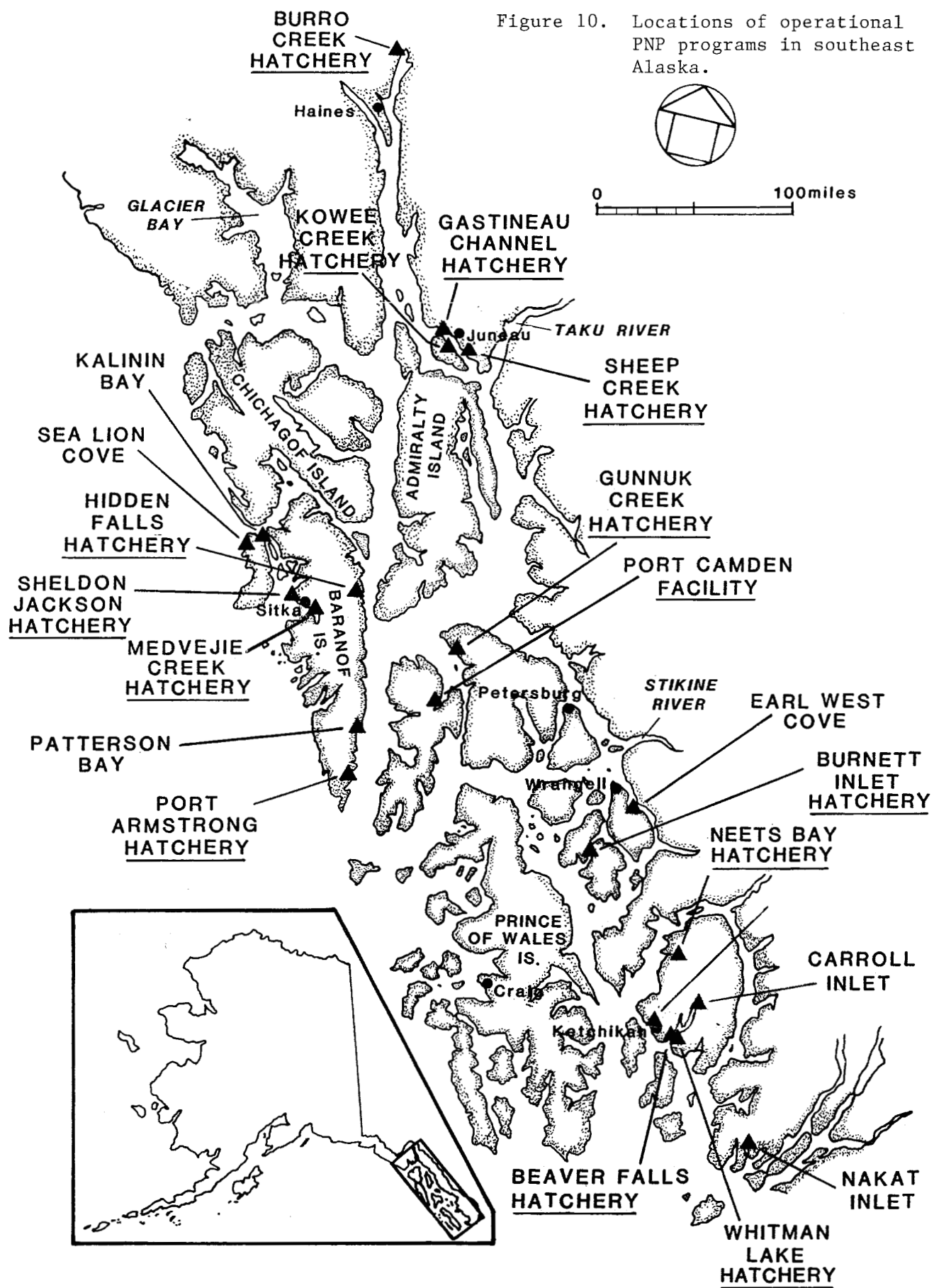
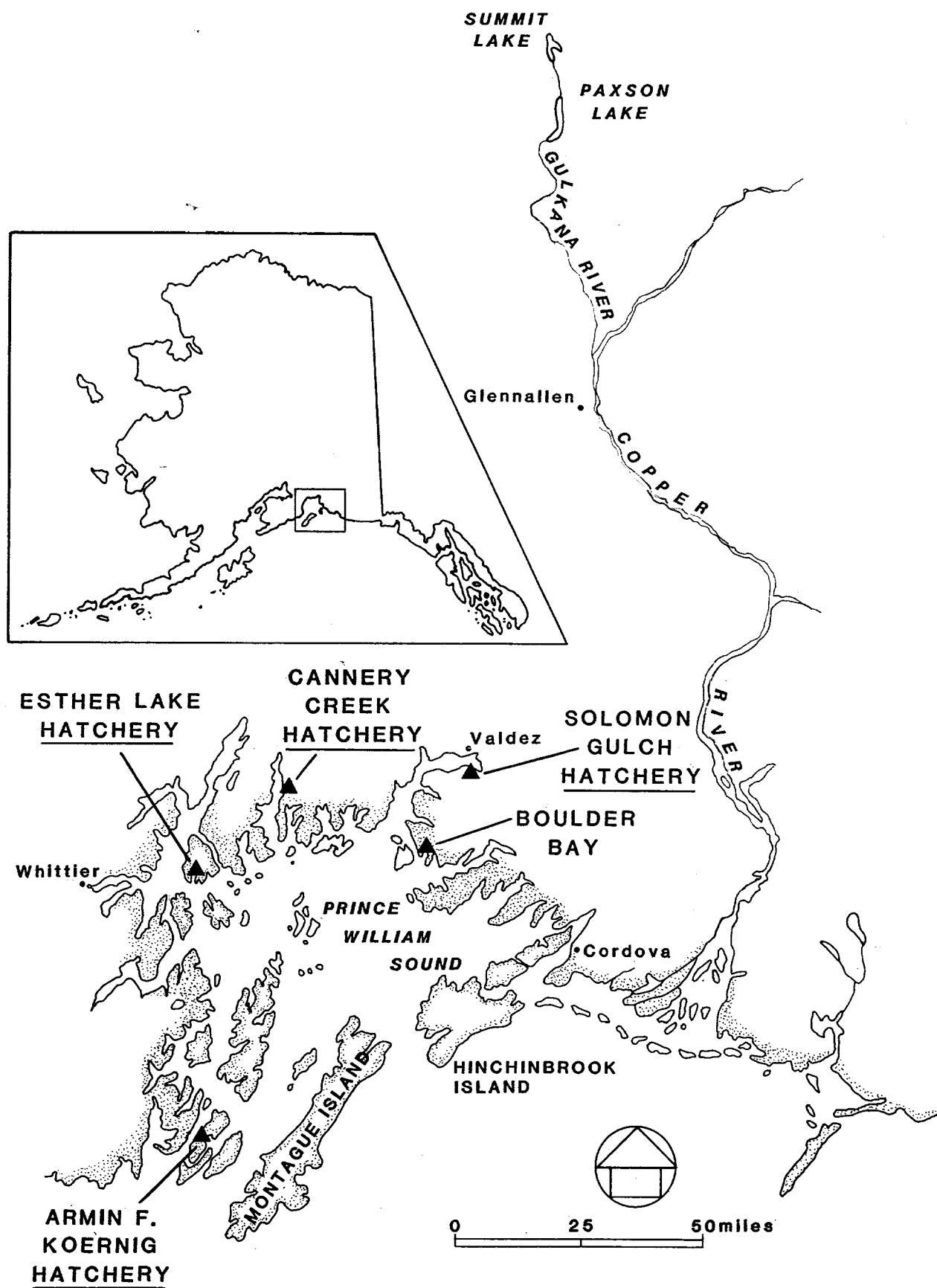


Figure 11. Locations of operational PNP programs in Prince William Sound.



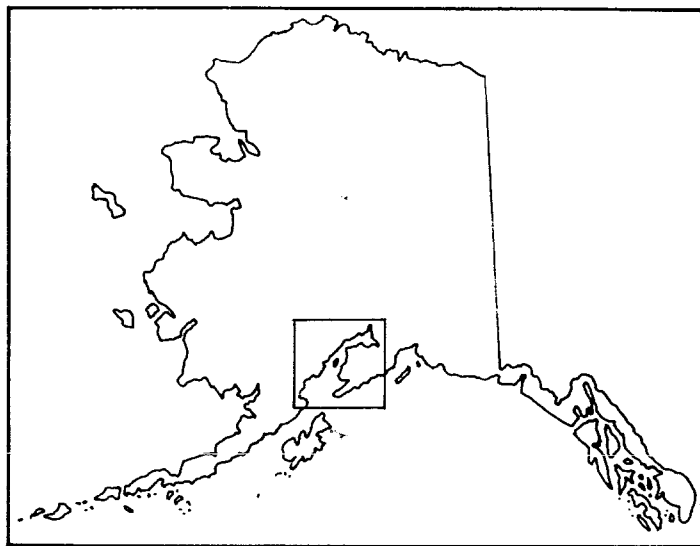


Figure 12. Locations of operational PNP programs in Cook Inlet.

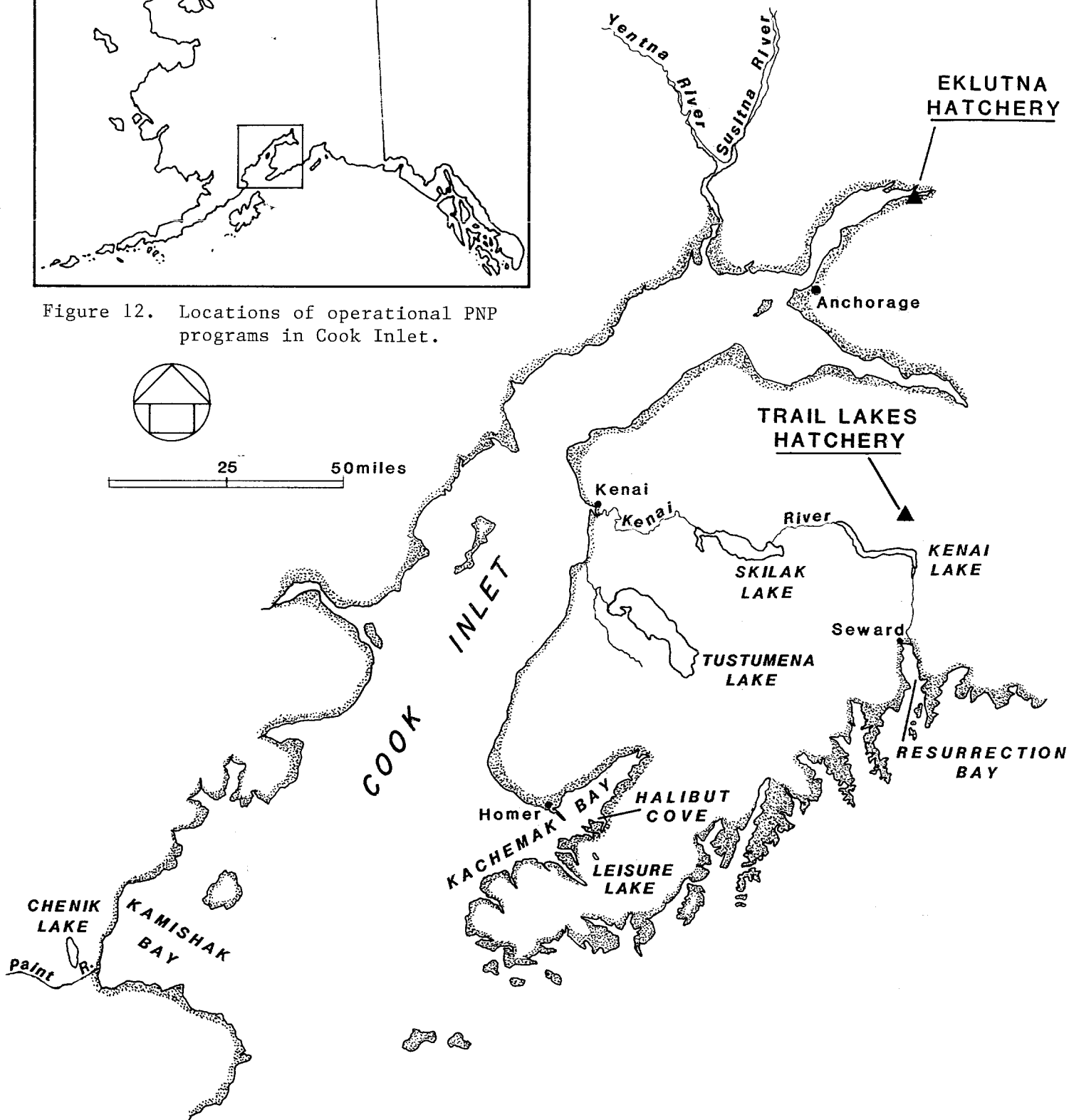


Table 7. 1989 estimated adult returns, by species, to PNP hatcheries
(including common property harvests) as reported by operators.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL	
SOUTHEAST							
SSRAA - Whitman Lake		243,940	11,776	8,730		264,446	(note 1)
- Neets Bay		204,543	18,087	26,148		248,778	(note 1)
- Beaver Falls					1	1	
NSRAA - Hidden Falls		154,963		398		155,361	(note 1&4)
- Medvejie Creek		131,407	26,041	289		157,737	(note 1&4)
AAI - Burnett Inlet	756,450	16,519	253			773,222	(note 1&2)
A-K - Port Armstrong	125,115	231		282		125,628	(note 1&2)
BCF - Burro Creek	5,000	50	100			5,150	(note 2)
DIPAC - Sheep Creek	91,595	33,712	700	1		126,008	(note 1,2&4)
- Kowee Creek		21	24			45	(note 1)
- Gastineau	44,303	839	10,008	82		55,232	
KNFC - Gunnuk Creek	58,291	19,817				78,108	(note 2)
MCAA - Meyers Chuck	16,502					16,502	(note 2)
SJC - Indian River	10,000	450	2,483	176		13,109	(note 1&3)
SOUTHEAST TOTALS	1,107,256	806,492	69,472	36,106	1	2,019,327	
PRINCE WILLIAM SOUND							
PWSAC - Armin F. Koernig	3,937,926	10,899				3,948,825	(note 4)
- Esther Lake	7,130,475	241,988	120,050	466		7,492,979	(note 4)
- Cannery Creek	6,946,635	6				6,946,641	(note 4)
VFDA - Solomon Gulch	3,438,764	35,000	108,383			3,582,147	(note 4)
PWS TOTALS	21,453,800	287,893	228,433	466	0	21,970,592	
COOK INLET							
CIAA - Eklutna		7,806	353			8,159	(note 2)
- Trail Lakes			6,790		39,831	46,621	
COOK INLET TOTALS	0	7,806	7,143	0	39,831	54,780	
KODIAK							
KRAA - Kitoi Bay	Listed under FRED hatchery production					0	
KODIAK TOTALS	0	0	0	0	0	0	
STATEWIDE TOTALS	22,561,056	1,102,191	305,048	36,572	39,832	24,044,699	

note 1: estimation based on expansion of coded wire tag recoveries.

note 2: estimation based on assumed common property interception rates.

note 3: estimation based on assumed marine survival rates.

note 4: estimation based on information provided by Division of Commercial Fisheries.

Table 8. Summary of statewide salmon production (all species) from PNP hatcheries as reported by operators.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1975	8,091,395				
1976	16,622,881	3,719,741			
1977	37,008,186	12,360,354	160,147	108,718	\$130,726.00
1978	37,346,167	26,796,238	160,967	114,188	\$141,799.00
1979	54,295,879	29,131,774	356,501	244,555	\$309,612.00
1980	125,740,500	35,587,200	1,506,466	346,168	\$436,171.00
1981	223,600,000	101,600,000	2,563,913	850,293	\$1,274,640.00
1982	234,390,000	126,990,000	5,340,720	1,370,110	\$1,165,608.00
1983	261,310,000	170,375,000	4,285,989	744,767	\$669,838.00
1984	372,880,000	217,730,000	4,764,144	1,048,701	\$1,668,788.00
1985	469,960,000	302,320,000	8,106,485	1,853,483	\$1,878,348.00
1986	522,200,000	380,890,000	7,903,526	1,211,620	\$1,867,054.45
1987	868,250,000	461,170,000	19,096,871	4,172,700	\$6,557,877.16
1988	1,045,620,000	819,800,000	14,343,654	2,499,557	\$9,266,780.00
1989	1,108,700,000	860,190,000	24,044,699	14,849,608	\$28,985,391.36
Cumulative hatchery revenue from special harvest:					\$54,352,632.97

Table 9. Summary of chum salmon production from PNP hatcheries.

Year	Egg Take	Fry release	Total return	Special harvest	Hatchery revenue
1975	77,000				
1976	347,275	66,075			
1977	1,614,574	264,068			
1978	1,684,930	1,064,000	543		
1979	6,782,864	924,400	3		
1980	26,850,000	3,340,000	1,588		
1981	32,400,000	21,900,000	20,518	6,115	\$24,640.00
1982	46,130,000	23,590,000	22,133	378	\$302.00
1983	68,790,000	41,770,000	126,783	35,099	\$37,120.00
1984	122,170,000	54,780,000	1,001,449	436,617	\$690,393.00
1985	119,450,000	97,880,000	525,088	123,215	\$209,208.00
1986	181,450,000	100,490,000	779,637	188,754	\$303,080.00
1987	234,500,000	149,790,000	955,294	487,605	\$1,162,578.50
1988	369,610,000	186,050,000	1,835,164	469,754	\$2,180,685.40
1989	267,030,000	286,770,000	1,102,191	183,340	\$754,806.00

Table 10. Summary of sockeye salmon production from PNP hatcheries

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1985	310,000	0	0	0	\$0.00
1986	1,295,700	102,000	0	0	\$0.00
1987	1,570,000	750,000	0	0	\$0.00
1988	10,590,000	1,000,000	66,499	0	\$0.00
1989	14,740,000	8,030,000	39,832	39,831	\$254,214.80

Table 11. Summary of pink salmon production from PNP hatcheries.

Year	Egg Take	Fry release	Total return	Special harvest	Hatchery revenue
1975	8,002,395				
1976	16,251,456	3,653,666			
1977	35,383,112	12,093,184	160,147	108,718	\$130,726.00
1978	34,851,807	25,732,238	160,397	114,188	\$141,799.00
1979	46,582,015	28,204,674	356,498	244,555	\$309,612.00
1980	98,030,000	31,690,000	1,504,878	346,168	\$436,171.00
1981	188,000,000	78,800,000	2,491,345	838,037	\$1,200,000.00
1982	185,170,000	102,550,000	5,253,378	1,354,732	\$1,084,806.00
1983	185,520,000	126,890,000	4,086,552	701,399	\$613,618.00
1984	241,760,000	159,340,000	3,637,927	583,185	\$741,673.00
1985	339,910,000	199,490,000	7,404,789	1,698,732	\$1,320,320.00
1986	324,570,000	271,960,000	6,767,984	948,624	\$1,012,420.00
1987	618,350,000	299,260,000	17,963,785	3,624,586	\$4,711,068.00
1988	645,100,000	625,820,000	12,257,959	2,007,720	\$6,715,887.09
1989	805,870,000	553,090,000	22,561,056	14,519,987	\$27,380,702.66

Table 12. Summary of coho salmon production from PNP hatcheries.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1975	12,000				
1976	24,150				
1977	10,500	3,102			
1978	809,430	0	27		
1979	931,000	2,700	0		
1980	666,500	557,200	0		
1981	2,800,000	900,000	52,050	6,141	\$50,000.00
1982	2,870,000	700,000	61,709	11,500	\$80,500.00
1983	6,200,000	1,570,000	71,781	7,396	\$19,100.00
1984	6,300,000	3,230,000	121,112	27,310	\$233,466.00
1985	4,100,000	4,220,000	168,427	29,530	\$293,820.00
1986	8,300,000	4,280,000	344,749	72,960	\$535,203.00
1987	9,280,000	5,440,000	169,149	58,333	\$625,546.65
1988	13,310,000	4,720,000	122,186	13,383	\$178,771.15
1989	13,740,000	9,040,000	305,048	88,702	\$271,181.23

Table 13. Summary of chinook salmon production from PNP hatcheries.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1980	194,000				
1981	400,000				
1982	220,000	150,000	3,500	3,500	N/A
1983	800,000	140,000	872	872	N/A
1984	2,730,000	380,000	3,656	1,589	\$3,256.00
1985	6,180,000	720,000	8,181	2,006	\$55,000.00
1986	6,580,000	4,050,000	11,156	1,282	\$16,351.00
1987	4,550,000	5,940,000	8,643	2,176	\$58,684.00
1988	7,010,000	2,210,000	23,246	8,700	\$191,436.36
1989	7,330,000	3,270,000	36,572	17,748	\$324,486.67

Table 14. 1989 releases from PNP hatcheries in millions.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST						
SSRAA - Whitman Lake		41.00	2.14	0.91	*	44.05
- Neets Bay		12.40	0.68	0.76		13.84
- Beaver Falls					0.29	0.29
NSRAA - Hidden Falls		60.30		0.34		60.65
- Medvejie Creek	0.34	16.37	1.45	0.74		18.91
- Port Camden		1.31				1.31
AAI - Burnett Inlet	5.54	7.48	0.04	0.17		13.23
A-K - Port Armstrong	16.04	0.04	*	0.09		16.17
BCF - Burro Creek	0.69	0.15	0.01			0.85
DIPAC - Kowee Creek	*	*				0.00
- Sheep Creek		26.42	*			26.42
- Gastineau	15.03	17.23	0.04	0.01		32.31
KNFC - Gunnuk Creek	4.19	9.88				14.07
SJC - Indian River	2.96	0.83	0.08	0.10		3.96
SOUTHEAST TOTALS	44.78	193.41	4.44	3.12	0.29	246.05
PRINCE WILLIAM SOUND						
PWSAC - Armin F. Koernig	160.27	*				160.27
- Esther Lake	160.49	79.85	2.50	0.15	2.06	245.04
- Cannery Creek	59.13	4.49				63.61
VFDA - Solomon Gulch	128.41	2.90	0.99			132.30
PWS TOTALS	508.30	87.23	3.49	0.15	2.06	601.22
COOK INLET						
CIAA - Eklutna	*	6.12	0.05	*		6.17
- Trail lakes			1.06	*	5.69	6.75
COOK INLET TOTALS	0.00	6.12	1.11	0.00	5.69	12.92
KODIAK						
KRAA - Kitoi Bay	Listed under FRED hatchery production					
KODIAK TOTALS	0.00	0.00	0.00	0.00	0.00	0.00
STATEWIDE TOTALS	553.09	286.77	9.04	3.27	8.03	860.19

Note 1: * indicates permitted species but no releases this season.

Note 2: individual hatchery releases may not add up to the regional or statewide totals because of rounding.

Table 15. 1989 egg takes for PNP hatcheries in millions.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL	Comments:
SOUTHEAST							
SSRAA - Whitman Lake		15.95	1.14	1.99	*	19.08	(note 1)
- Neets Bay		27.45	3.30	1.60		32.35	
- Beaver Falls					0.95	0.95	
NSRAA - Hidden Falls		84.39		0.45		84.84	
- Medvejie Creek	0.02	38.27	2.22	1.57		42.08	
- Port Camden		1.35				1.35	
AAI - Burnett Inlet	38.37	2.80	0.07	0.35		41.59	
A-K - Port Armstrong	24.00	0.16	0.28	0.16		24.60	
BCF - Burro Creek	3.19	0.13	0.02			3.33	
DIPAC - Kowee Creek	*	*				0.00	(note 1)
- Sheep Creek	17.73	*	*			17.73	(note 1)
- Gastineau	10.22	18.59	1.45	0.04		30.29	
KNFC - Gunnuk Creek	5.99	12.01				18.00	
MCAA - Meyers Chuck	*	*	*			0.00	(note 1)
SJC - Indian River	5.85	0.39	0.13	0.06		6.42	
SOUTHEAST TOTALS	105.37	201.47	8.60	6.21	0.95	322.60	(note 2)
PRINCE WILLIAM SOUND							
PWSAC - Armin F. Koernig	126.90	0.14				127.04	
- Esther Lake	269.63	54.21	2.60	1.12	2.99	330.53	
- Cannery Creek	161.15	*				161.15	(note 1)
VFDA - Solomon Gulch	142.83	6.95	1.55	*		151.32	(note 1)
PWS TOTALS	700.50	61.29	4.14	1.12	2.99	770.04	(note 2)
COOK INLET							
CIAA - Eklutna	*	4.26	0.05	*		4.31	(note 1)
- Trail Lakes			0.95	*	10.80	11.75	(note 1)
COOK INLET TOTALS	0.00	4.26	1.00	0.00	10.80	16.06	(note 2)
KODIAK							
KRAA - Kitoi Bay	Listed under FRED hatchery production						
KODIAK TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	(note 2)
STATEWIDE TOTALS	805.87	267.03	13.74	7.33	14.74	1108.70	
ALL SPECIES TOTAL: 1,108,700,000							

Note 1: * indicates permitted species but no egg take this season.

Note 2: individual hatchery egg takes may not add up to the regional or statewide totals because of rounding.

takes also increased over those in 1988. However, chum salmon egg takes decreased by over 27% from 1988 levels due to poorer-than-expected returns in southeast Alaska and Prince William Sound.

Many PNP hatcheries are currently in the process of broodstock development and, consequently, have not reached their permitted capacities. Permitted capacities for PNP hatcheries now total over 1.58 billion eggs, an increase of a modest 8.2 million from 1988 levels (Table 16). Potential returns from statewide PNP hatchery-originated production at the 1.6 billion-egg level should exceed 25 million adults, assuming FRED standard assumptions of hatchery and marine survival. Exceptional marine survival, similar to that experienced during recent years, could boost adult production considerably over these estimates. Under the existing permits, approximately 52% of hatchery capacity is scheduled for pink salmon, 41% for chum salmon, and 7% for steelhead trout, and sockeye, coho, and chinook salmon.

For the 1990 season projected returns to PNP facilities in southeast Alaska are expected to include approximately 37,000 chinook salmon, 75,000 coho salmon, 924,000 chum salmon, and 798,000 pink salmon. Returns of both chum and coho salmon are expected to be below normal in southeast Alaska. Returns to PNP facilities in Prince William Sound are projected at 20,997,000 pink salmon, 620,000 chum salmon, and 475,000 coho salmon for 1990.

Significant hatchery special harvests are expected at the Armin F. Koernig, Esther Lake, Cannery Creek, Solomon Gulch, Kitoi Bay, Sheldon Jackson College, Neets Bay, Port Armstrong, Burnett Inlet, Hidden Falls, and Medvejie Creek Hatcheries. Significant common-property terminal harvests by commercial gear groups are expected at the Kitoi Bay, Esther Lake, Cannery Creek, Neets Bay, and Whitman Lake (Nakat Inlet, Carroll Inlet, and Earl West Cove) Hatcheries.

Annual Management Plans

The PNP regulations require that ADF&G prepare, in conjunction with PNP permit holders, an annual management plan (AMP) to guide hatchery operations for the succeeding calendar year.

AMPs will be developed for 16 state and 22 PNP hatchery facilities prior to the 1989 operating season. The AMPs will be reviewed by both the department and the RPTs before final approval by the Commissioner. The AMPs outline expected operational activities at each facility, including wild and hatchery egg takes, proposed fish and egg transports and releases, anticipated adult returns, anticipated impacts on the management of mixed-stock fisheries, and terminal-harvest management strategies. Also included are anticipated facility broodstock requirements and, in the case of PNP facilities, hatchery cost-recovery plans that identify legal gear types for hatchery harvest and the number of fish required in order to meet capital and operating expenses.

Table 16. Permitted egg capacities, in millions, of PNP hatcheries within the planning regions, 1989.

REGION	Pink	Chum	Coho	Chinook	Sockeye	Steelhead	Total
SOUTHERN SOUTHEAST							
Association Facilities	0.00	91.80	8.40	5.50	4.00		109.70
Non-Association Facilities	21.00	47.00	1.25	0.75			70.00
total	21.00	138.80	9.65	6.25	4.00		179.70
NORTHERN SOUTHEAST							
Association Facilities	0.30	136.00	3.37	5.10			144.77
Non-Association Facilities	114.00	210.50	3.25	0.38		0.09	328.22
total	114.30	346.50	6.62	5.48	0.00	0.09	472.99
YAKUTAT (no PNP facilities)							
total	0.00	0.00	0.00	0.00	0.00		0.00
PRINCE WILLIAM SOUND							
Association Facilities	508.00	129.00	4.00	4.00	31.00		676.00
Non-Association Facilities	166.00	28.00	2.00	0.30			196.30
total	674.00	157.00	6.00	4.30	31.00		872.30
COOK INLET							
Association Facilities	10.00	10.00	7.10	4.10	30.00		61.20
total	10.00	10.00	7.10	4.10	30.00		61.20
STATEWIDE TOTALS	819.30	652.30	29.37	20.13	65.00	0.09	1586.19

PROGRAM EXPENDITURES

Fiscal Year 1990 Operating Budget

The FRED Division, as a Budget Request Unit (BRU), requests operating funds in two components, a change from prior years when a third component, CIP, was also requested. Approximately 96% of the FY 89 authorized budget is in the FRED component, which includes all of the division's operational, technical, and administrative functions. The remaining BRU component is Special Projects. Special projects are those that are contracted from federal agencies, such as the USFS, or when funds are received from other sources, such as interagency receipts. Much of the monies received for special projects during FY 90 were from U.S./Canada Pacific Salmon Treaty mitigation funds for projects dealing with sockeye and chum salmon in southeast Alaska. The total FY 90 budget for the FRED Division BRU is \$15.5 million. The General Fund portion of the FY 90 funding increased by 0.7% from the FY 89 authorized budget following several years of significant decreases.

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<u>Report Section</u>	<u>Contributor</u>
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APPENDICES

APPENDIX 1

Stocking Location by Species for Fish Released in 1989

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
28 MILE PIT	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	280	19.400
31 MILE PIT	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	630	19.400
BACKDOWN L	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	126	20.000
BATHING BEAUTY	AYK	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	250	142.800
BATHING BEAUTY	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	125	19.400
BRODE L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	350	20.000
CHENA HS #32.9	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	110	19.970
CHENA L	AYK	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	2,498	143.600
DICK'S POND	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	200	20.000
DOC L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	100	20.000
GRAYLING L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	260	19.400
HARDING L	AYK	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	49,372	286.105
HARDING L	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	12,635	19.970
HIDDEN L (FAIR)	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	630	19.400
KENS POND	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	100	20.000
L HARDING L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	1,260	19.400
LAST L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	589	20.000
LOST L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	1,640	19.400
MANCHU L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	1,000	19.400
RANGEVIEW L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	315	20.000
STEESE HWY 30.6	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	50	19.970
STEESE HWY 36.6	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	50	19.970
WEIGH STATION-1	AYK	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	250	142.800
WEIGH STATION-1	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	350	19.400
WEIGH STATION-2	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	350	19.400
CAMPBELL PT L	NCI	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	500	108.000
CLUNIE L	NCI	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	1,000	108.000
GWEN L	NCI	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	500	108.000
IRENE L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	1,800	19.300
MARION L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	7,370	19.300
MIRROR L	NCI	ARCTIC CHAR	CLEAR H	CATCHABLE	ALEKNAGIK L	500	108.000
CROOKED CR	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	335,095	15.713
LOWELL CR	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	122,800	13.540
SEWARD LAGOON	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	109,464	14.900
SPRING CR	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	75,063	16.180
CRYSTAL CR	CSE	CHINOOK	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	479,381	12.380
EARL WEST COVE	CSE	CHINOOK	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	394,200	22.640
OHMER CR	CSE	CHINOOK	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	228,569	8.440
LAKE ISLAND C	KOD	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	114,400	13.000
HALIBUT COVE LG	LCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	115,682	16.000
HOMER SPIT	LCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	212,737	16.450

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
SELDOVIA HARBOR	LCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	108,300	17.470
NINILCHIK R	LCI	CHINOOK	FT RICHARDSON H	SMOLT	NINILCHIK R	199,605	11.800
MATANUSKA L	NCI	CHINOOK	ELMENDORF H	FINGERLING	CROOKED CR	12,565	4.900
MEMORY L	NCI	CHINOOK	ELMENDORF H	FINGERLING	CROOKED CR	17,551	13.000
SHIP CR	NCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	30,684	15.700
SHIP CR	NCI	CHINOOK	ELMENDORF H	SMOLT	SHIP CR	89,986	15.440
CHENEY L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	7,540	66.600
CLUNIE L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	3,891	66.600
DECEPTION CR	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	240,945	13.000
DELONG L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	3,081	66.600
JEWEL L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	10,297	66.600
MIRROR L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	5,405	66.600
MONTANA CR	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	185,130	12.300
OTTER L (FT R)	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	5,919	66.600
SAND L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	9,756	66.600
SHEEP CR	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	208,179	12.300
AUKE BAY CR	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	117,000	13.900
FISH CR (JNO)	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	67,000	14.000
GASTINEAU H	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	11,000	10.370
MONTANA CR	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	33,000	8.500
SHEEP CR	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	120,000	15.600
SNETTISHAM INLT	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	127,000	9.250
SNETTISHAM INLT	NSE	CHINOOK	SNETTISHAM H	SMOLT	KING SALMON R	72,004	11.760
SNETTISHAM INLT	NSE	CHINOOK	SNETTISHAM H	SMOLT	SNETTISHAM INLT	677,000	10.370
MONSOON L	PWS	CHINOOK	GULKANA II H	FED FRY	GULKANA E FORK	15,977	0.600
KETCHIKAN CR	SSE	CHINOOK	DEER MOUNTAIN H	SMOLT	KETCHIKAN CR	166,784	14.382
THORNE BAY	SSE	CHINOOK	DEER MOUNTAIN H	SMOLT	KETCHIKAN CR	24,305	20.000
NOATAK R	AYK	CHUM	SIKUSUILAQ H	EMERGENT F	NOATAK R	6,051,870	0.330
BIG KITOI CR	KOD	CHUM	KITOI H	FINGERLING	BIG KITOI CR	3,289,878	1.850
TUTKA BAY	LCI	CHUM	TUTKA BAY H	FED FRY	TUTKA BAY	802,969	0.579
TUTKA CR	LCI	CHUM	TUTKA BAY H	EMERGENT F	TUTKA BAY	1,361,424	0.242
LIMESTONE CR	NSE	CHUM	SNETTISHAM H	FED FRY	SNETTISHAM INLT	5,710,000	1.200
SNETTISHAM INLT	NSE	CHUM	SNETTISHAM H	FED FRY	SNETTISHAM INLT	693,000	1.200
MARX CR	SSE	CHUM	MARX CR SPWN CH	EMERGENT F	FISH CR (JNO)	4,210,982	0.430
28 MILE PIT	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	1,600	4.240

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
31 MILE PIT	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	1,600	4.240
8 MILE L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	5,000	4.240
BIRCH L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	40,000	4.240
CHENA L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	15,000	4.040
CLEAR CR	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	80,000	2.460
DEAD DOG PIT	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	216,845	0.270
DUNE L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	10,000	4.110
EARTHMOVER PIT	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	1,000	4.240
GESKAMINA L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	10,000	4.110
HANGER PIT	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	2,600	4.240
JOHNSON PIT #1	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	500	4.240
JUNE CR	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	25,488	4.240
LONG POND	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	700	4.240
LOST L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	4,700	4.240
MANCHU L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	2,900	4.240
MOOSE L (EIEL)	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	10,000	4.240
OTTO L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	20,000	4.240
QUARTZ L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	150,010	4.050
ROUND POND	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	400	4.240
SANSING L	AYK	COHO	CLEAR H	FINGERLING	WOOD CR	200	4.240
WOOD CR	AYK	COHO	CLEAR H	FED FRY	WOOD CR	80,000	2.460
LOWELL CR	CCI	COHO	ELMENDORF H	SMOLT	BEAR L	66,606	21.540
SEWARD LAGOON	CCI	COHO	ELMENDORF H	SMOLT	BEAR L	152,161	19.975
CROOKED CR	CCI	COHO	CROOKED CR H	SMOLT	CROOKED CR	70,681	27.200
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	EMERGENT F	CRYSTAL CR	345,927	0.300
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	104,157	10.220
HAMMER SLOUGH	CSE	COHO	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	2,000	10.220
SANDY BEACH CR	CSE	COHO	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	2,000	10.220
SLIPPERY CR	CSE	COHO	CRYSTAL LAKE H	FED FRY	CRYSTAL CR	378,095	0.800
ST JOHN'S CR	CSE	COHO	CRYSTAL LAKE H	FED FRY	CRYSTAL CR	76,453	1.010
CRESCENT L (KOD)	KOD	COHO	KITOI H	FINGERLING	L KITOI L	202,955	0.820
DARK L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	7,572	1.000
HIDDEN L (KOD)	KOD	COHO	KITOI H	FINGERLING	L KITOI L	239,817	0.850
ISLAND L (KOD)	KOD	COHO	KITOI H	FINGERLING	L KITOI L	22,500	1.000
KALSIN L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	19,543	1.000
MAYFLOWER L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	6,870	0.800
MISSION L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	10,000	0.800
ORBIN L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	7,500	0.800
PONY L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	2,600	1.000
POTATOE L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	7,500	0.800
SOUTHERN L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	3,500	1.000
MORTENSON CR	KOD	COHO	RUSSELL CR H	SMOLT	MORTENSON CR	34,000	11.500
HOMER SPIT	LCI	COHO	ELMENDORF H	SMOLT	BEAR L	153,855	20.695

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
BEAR PAW L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	8,880	4.900
ECHO L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	4,596	4.700
FINGER L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	37,410	4.900
JUNCTION L-PALM	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	1,697	4.700
KNIK L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	5,000	4.900
LOON L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	20,695	4.900
LUCILLE L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	17,161	4.900
PRATOR L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	19,500	4.900
ROCKY L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	9,250	4.900
VICTOR L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	6,680	4.700
WOLF L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	12,735	4.900
BIG L (BIG L)	NCI	COHO	BIG LAKE H	SUBCATCH	BIG L (BIG L)	15,044	15.817
COTTONWOOD CR	NCI	COHO	BIG LAKE H	SUBCATCH	BIG L (BIG L)	16,900	16.200
JIM CR	NCI	COHO	BIG LAKE H	SUBCATCH	BIG L (BIG L)	20,100	16.320
ROCKY L	NCI	COHO	BIG LAKE H	SUBCATCH	BIG L (BIG L)	450	130.000
WASILLA CR	NCI	COHO	BIG LAKE H	SUBCATCH	BIG L (BIG L)	21,600	15.740
BENKA L	NCI	COHO	FT RICHARDSON H	FINGERLING	CASWELL CR	12,400	2.600
CASWELL CR	NCI	COHO	FT RICHARDSON H	SMOLT	CASWELL CR	161,822	19.800
CHENEY L	NCI	COHO	FT RICHARDSON H	FINGERLING	CASWELL CR	50,031	2.500
CHRISTENSEN L	NCI	COHO	FT RICHARDSON H	FINGERLING	CASWELL CR	55,446	2.600
OTTER L (FT R)	NCI	COHO	FT RICHARDSON H	FINGERLING	CASWELL CR	10,280	2.500
SAND L	NCI	COHO	FT RICHARDSON H	FINGERLING	CASWELL CR	40,444	2.600
OTTER L (FT R)	NCI	COHO	FT RICHARDSON H	FINGERLING	FLEMING SPIT	81,673	2.510
HORSESHOE L	NCI	COHO	BIG LAKE H	FED FRY	L SUSITNA R	8,400	1.350
L SUSITNA R	NCI	COHO	FT RICHARDSON H	SMOLT	L SUSITNA R	52,930	18.500
NANCY L	NCI	COHO	FT RICHARDSON H	FINGERLING	L SUSITNA R	333,250	2.000
NANCY L	NCI	COHO	FT RICHARDSON H	SMOLT	L SUSITNA R	305,706	20.233
SHIP CR	NCI	COHO	ELMENDORF H	SMOLT	SHIP CR	56,841	21.580
TAKU CAMPBELL L	NCI	COHO	ELMENDORF H	SMOLT	SHIP CR	15,386	1.400
DREDGE L	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	36,994	38.500
FISH CR (JNO)	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	42,000	39.500
SHEEP CR	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	44,940	40.200
SNETTISHAM INLT	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	71,000	36.400
TWIN L	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	9,385	72.273
FLEMING SPIT	PWS	COHO	FT RICHARDSON H	SMOLT	FLEMING SPIT	69,400	19.600
WHITTIER HARBOR	PWS	COHO	FT RICHARDSON H	SMOLT	FLEMING SPIT	82,429	18.800
STRELNA L	PWS	COHO	CLEAR H	FINGERLING	WOOD CR	58,000	3.370
CABLE CR	SSE	COHO	KLAWOCK H	FINGERLING	CABLE CR	47,058	6.100
KLAWOCK L	SSE	COHO	KLAWOCK H	SMOLT	KLAWOCK L	1,162,725	18.513
TUNGA L	SSE	COHO	KLAWOCK H	SMOLT	KLAWOCK L	174,804	8.900
KLAWOCK L	SSE	COHO	KLAWOCK H	SMOLT	KLAWOCK R	1,157,796	15.400
KETCHIKAN CR	SSE	COHO	DEER MOUNTAIN H	SMOLT	REFLECTION L	72,716	18.725
REFLECTION L	SSE	COHO	DEER MOUNTAIN H	FED FRY	REFLECTION L	84,567	2.695
WARD L	SSE	COHO	DEER MOUNTAIN H	SMOLT	REFLECTION L	55,663	14.790

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
RIO ROBERTS CR.	SSE	COHO	KLAWOCK H	SMOLT	RIO ROBERTS CR.	9,826	16.400
TUNGA L	SSE	COHO	KLAWOCK H	SMOLT	RIO ROBERTS CR.	2,373	9.760
"J" L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
180 PARKS HWY	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	1,000	7.400
31 MILE PIT	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
81 MILE PIT	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	5,000	0.018
BOLIO L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	20,000	0.018
CHENA HS #30.9	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	650	3.150
CHENA HS #32.9	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	310	3.150
CHENA HS #42.8	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	1,000	3.150
CHENA HS #45.5	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	500	3.150
CHENA HS #47.9	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	400	3.150
DUNE L	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	5,000	2.510
EARTHMOVER PIT	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	239,254	0.016
FIREBREAK L	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	2,000	2.510
GRAYLING L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
GRAYLING L	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	1,000	5.360
HIDDEN L (FAIR)	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	1,800	5.360
JOHNSON PIT #1	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	1,000	5.360
JOHNSON PIT #2	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
LONG POND	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.017
OTTO L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	712,112	0.018
ROUND POND	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.017
STEESE HWY 29.5	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	500	3.150
STEESE HWY 30.6	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	125	3.150
STEESE HWY 33.0	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	750	3.150
STEESE HWY 33.5	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	500	3.150
STEESE HWY 34.6	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	400	3.150
STEESE HWY 35.8	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	300	3.150
STEESE HWY 36.6	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	125	3.150
TRAP L	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	4,000	2.510
WALDEN POND	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	350	3.150
AUREL L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	20,000	0.018
CASCADE L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	20,000	0.018
HEITMAN L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	70,000	0.018
"Y" L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	1,800	8.430
17 MILE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	9,598	7.640
BEACH L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	4,000	7.400
BRUCE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	2,000	8.430
CANOE L	NCI	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	21,200	0.018
CANOE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	4,200	7.640
KEPLER-BRADLY L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	5,800	7.640
KNIK L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	3,000	8.430

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
LONG L (MI86)	NCI	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	64,000	0.018
LONG L (MI86)	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	7,000	8.430
LOWER FIRE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	7,000	7.400
LUCILLE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	4,000	8.430
MATANUSKA L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	6,100	8.430
MEIRS L	NCI	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	16,700	0.018
MEIRS L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	3,400	7.640
WALDEN L (FT R)	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	4,000	7.400
WILLOW L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L (GLEN)	3,300	8.430
BEAVER L(SITKA)	NSE	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	15,000	0.018
SWAN L (SIT)	NSE	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	15,000	0.018
28.5 MI L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
ALAGANIK SL L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
JUNCTION L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	3,500	0.018
MOOSE L (GLEN)	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	50,000	0.018
PIPELINE L #2	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	20,000	0.018
SHERIDAN DIKE 1	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
SHERIDAN DIKE 2	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
SQUIRREL CR L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	5,000	0.018
THOMPSON L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	10,000	0.018
TOLSONA L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L (GLEN)	80,000	0.018
BATHING BEAUTY	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	350	6.310
BULLWINKLE L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	400	6.310
CHENA HS #47.9	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	400	6.050
CHET L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	800	6.310
COAL MINE #5	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	2,600	6.310
GHOST L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	500	6.310
GRAYLING L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	1,000	6.310
GRAYLING L	AYK	LAKE TROUT	CLEAR H	SUBCATCH	PAXON L	550	20.480
HIDDEN L(FAIR)	AYK	LAKE TROUT	CLEAR H	SUBCATCH	PAXON L	600	20.480
LONG L (FBK)	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	10,600	5.840
LOST L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	4,700	6.310
LOST L	AYK	LAKE TROUT	CLEAR H	SUBCATCH	PAXON L	1,500	20.480
NICKEL L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	500	6.310
PAUL'S POND	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	1,000	6.310
ROCKHOUND L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	300	6.310
SHEEFISH L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	800	6.310
SILVER FOX L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	1,200	6.310
SILVER FOX L	AYK	LAKE TROUT	CLEAR H	SUBCATCH	PAXON L	350	20.480
STEESE HWY 29.5	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	500	6.050
STEESE HWY 34.6	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	400	6.050
SUMMIT L	AYK	LAKE TROUT	CLEAR H	SUBCATCH	PAXON L	2,000	20.300
TRIANGLE L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	10,000	6.210

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
W TWIN L	AYK	LAKE TROUT	CLEAR H	SUBCATCH	PAXON L	25,576	22.220
PAXON L	PWS	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	20,000	6.050
SUMMIT L (PAX)	PWS	LAKE TROUT	CLEAR H	FINGERLING	PAXON L	7,259	6.050
RUSSELL CR	AKP	PINK	RUSSELL CR H	FED FRY	RUSSELL CR	1,900,000	0.250
BIG KITOI CR	KOD	PINK	KITOI H	EMERGENT F	BIG KITOI CR	405,483	0.280
BIG KITOI CR	KOD	PINK	KITOI H	FINGERLING	BIG KITOI CR	80,096,737	0.620
TUTKA BAY	LCI	PINK	TUTKA BAY H	FED FRY	TUTKA BAY	20,533,867	0.579
TUTKA CR	LCI	PINK	TUTKA BAY H	EMERGENT F	TUTKA BAY	7,684,122	0.242
TUTKA LAGOON	LCI	PINK	TUTKA BAY H	FED FRY	TUTKA BAY	1,853,064	0.579
INGRAM CR	NCI	PINK	TUTKA BAY H	EMERGENT F	TUTKA BAY	325,380	0.230
MAIN BAY	PWS	PINK	MAIN BAY H	EMERGENT F	SAN JUAN	6,200,000	0.280
MAIN BAY	PWS	PINK	MAIN BAY H	FED FRY	SAN JUAN	4,000,000	0.390
28 MILE PIT	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	16.570
31 MILE PIT	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	1.200
BACKDOWN L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	600	1.060
BATHING BEAUTY	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	350	1.200
BIRCH L	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,045	111.900
BIRCH L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	50,000	16.217
BLUFF CABIN	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	14,000	1.030
BULLWINKLE L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	400	1.060
CHENA HS #45.5	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	600	1.020
CHENA L	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	30,481	92.500
CHET L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	800	1.060
COAL MINE #5	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	2,600	1.060
DERBY L	AYK	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	25	1500.000
DERBY L	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	500	95.000
DOC L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	520	1.060
DONNA L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	15,000	1.030
DONNELLY L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	6,400	1.060
DUNE L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	10,000	1.030
EARTHMOVER PIT	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	800	1.060
FIREBREAK L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	2,000	1.030
GESKAMINA L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	18,000	1.030
GHOST L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	1.060
GRAYLING L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	1,000	1.200
HANGER PIT	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	1,300	1.060
HARDING L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	193,757	1.200
HIDDEN L (FAIR)	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	900	1.200

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
JAN L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	8,800	1.200
JOHNSON PIT #1	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	2,500	8.885
KENS POND	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	1.060
KOOLE L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	30,000	1.150
L DONNA L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	6,000	1.030
L HARDING L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	1,000	16.570
LES'S L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	800	1.020
LISA L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	10,000	1.030
LOST L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	4,700	1.200
LUKE L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	1,600	1.060
MANCHU L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	2,900	1.060
MARK L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	3,600	1.060
MONTE L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	15,000	1.150
N TWIN L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	2,000	1.060
NICKEL L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	1.060
OLNES POND	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	1,500	1.020
PAUL'S POND	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	1.060
PILEDRIIVE SL-BB	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	25,655	98.450
PILEDRIIVE SL-BB	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	43,553	13.100
QUARTZ L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	163,316	8.950
QUARTZ L	AYK	RAINBOW	CLEAR H	SUBCATCH	SWANSON R	29,659	30.750
QUARTZ L (FBK)	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	4,028	25.000
RAINBOW L (FBK)	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	15,000	1.150
RAPID L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	2,000	1.060
ROCKHOUND L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	300	1.060
S TWIN L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	4,000	1.060
SANSING L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	500	25.800
SOUTH JAN L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	20,024	1.230
SPENCER L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	10,000	8.795
STEESE HWY 39.5	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	1,000	1.020
WEASEL L	AYK	RAINBOW	CLEAR H	FINGERLING	SWANSON R	800	1.060
CABIN L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,021	1.360
CECILE L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,000	1.360
COOPER L	CCI	RAINBOW	FT RICHARDSON H	FED FRY	SWANSON R	275,569	0.170
DOUGLAS L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,987	1.360
EGAN CENTER	CCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	800	900.000
JEROME L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,000	1.400
JOHNSON L-KASI	CCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	9,740	90.000
JOHNSON L-KASI	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,027	1.480
LONGMARE L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	34,000	1.800
MERIDIAN L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,000	1.400
QUINTIN L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,000	1.480
SPORT L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,000	1.480
STORMY L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	50,138	1.380
U SUMMIT L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	63,888	1.800
VAGT L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,000	1.400

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
ABERCROMBIE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,700	1.280
AUREL L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,000	1.280
BIG L (KOD)	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.280
BULL L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,000	1.280
CAROLINE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,400	1.280
CICELY L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,150	1.280
DOLGOI L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	8,000	1.280
DRAGONFLY L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,550	1.280
HEITMAN L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,250	1.280
HORSESHOE L-KOD	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.280
JACK L-KOD	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.280
JUPITER L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.280
LEE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,800	1.280
LILLY L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,600	1.280
LONG L (KOD)	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.280
LUPINE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,600	1.280
MARGARET L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,600	1.280
SATURN L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,400	1.280
TANIGNAK L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	7,375	1.280
TWIN L (KOD)	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,000	1.280
BEACH L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	7	1587.000
BIG L (BIG L)	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	216,371	1.300
BLODGETT L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	5,800	0.930
CHENEY L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	13	1587.000
CLUNIE L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	15	1587.000
DELONG L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	13	1587.000
EKLUTNA L	NCI	RAINBOW	FT RICHARDSON H	FED FRY	BIG L (BIG L)	212,000	0.200
EKLUTNA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	45,400	2.200
JEWEL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	12	1587.000
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	9	1587.000
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	9	1474.000
SAND L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	14	1587.000
SEYMOUR L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	47,699	0.930
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	14	1587.000
"X" L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	20,487	1.500
"Y" L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,970	1.100
17 MILE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	10,000	1.100
B-J L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,149	1.500
BARLEY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,720	1.500
BEACH L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	26	1587.000
BEACH L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	6,583	97.767
BENCH CR	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,264	1.500
BEVERLY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	16,800	1.500
BIG NO LUCK	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	7,051	1.500
CAMPBELL CR	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	9,235	89.367
CAMPBELL PT L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,998	96.500

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
CARPENTER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	35,280	1.500
CHENEY L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	50	1587.000
CHENEY L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	12,352	108.567
CHESTER CR	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,467	96.300
CHRISTENSEN L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,900	1.100
CLUNIE L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	61	1587.000
CLUNIE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	10,737	96.500
COYOTE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	734	76.000
CRYSTAL L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	105,442	1.500
DAWN L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,440	1.500
DELONG L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	52	1587.000
DELONG L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	12,118	84.725
DIAMOND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	55,600	1.100
DISHNO L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,015	78.000
ECHO L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,736	141.000
EKLUTNA L	NCI	RAINBOW	FT RICHARDSON H	FED FRY	SWANSON R	770,278	0.170
EKLUTNA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	356,972	1.593
FINGER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	36,608	1.400
FIRE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,096	85.000
FISH L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,108	78.000
FLORENCE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,460	1.100
GOLF COURSE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	125	75.000
GREEN L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,993	84.000
GWEN L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,767	92.900
HILLBERG L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,510	87.000
HONEYBEE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	46,150	1.400
IRENE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,060	76.000
JEWEL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	49	1587.000
JEWEL L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	20,485	102.350
JOHNSON L-PALM	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,074	2.800
KALMBACK L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	52,000	1.500
KASHWITNA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,200	1.100
KEPLER-BRADLY L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	15,911	76.450
KEPLER-BRADLY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,822	1.500
KNIK L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,653	76.000
KNIK L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,000	1.500
L LONELY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	44,805	1.300
LAKE OTIS	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,507	96.000
LONG	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,000	1.400
LONG L (KB)	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	29,914	1.500
LORRAINE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	13,152	1.100
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	35	1587.000
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	6,618	95.000
LUCILLE L	NCI	RAINBOW	FT RICHARDSON H	SUBCATCH	SWANSON R	11,000	38.700
LYNNE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,990	1.400
MARION L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	11,300	1.500
MATANUSKA L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	17,589	77.050

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
MIRROR L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,456	102.600
MORVO L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,320	1.100
N FRIEND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	8,140	1.100
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	37	1474.000
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,352	116.950
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	64,717	29.275
PORTAGE VALLY L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	5,181	104.100
RAVINE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,500	1.100
REED L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,828	2.500
ROBIN L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.500
S FRIEND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,570	1.100
SAND L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	54	1587.000
SAND L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	9,767	86.000
SIX MILE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,473	88.000
SLIPPER L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	592	76.000
SOUTH ROLLY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	10,770	1.100
SPRING L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,015	78.000
SUNDI L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,530	101.300
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	57	1587.000
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,104	89.900
THOMPSON L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,030	78.000
TIGGER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,020	1.500
TRIANGLE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,256	86.000
TWIN ISLAND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	16,137	1.500
VERA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	11,025	1.300
WALBY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,390	1.500
WALDEN L (FT R)	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,383	95.000
WEINER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,140	1.100
WISHBONE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,272	1.230
MIRROR L	PWS	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	7	1587.000
TWO MILE L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	3,364	1.320
WOTHINGTON L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	7,946	1.320
BUFFALO L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	525	96.000
BUFFALO L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	800	1.230
MIRROR L	PWS	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	29	1587.000
MIRROR L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	11,914	90.675
MIRROR L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,024	1.230
OLD ROAD L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	375	96.000
PEANUT L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,398	1.230
ROUND L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	319	96.000
RUTH L (GLEN)	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,002	104.000
SCULPIN L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	28,059	1.100
TINY L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	500	1.230
TOLSONA L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	30,000	1.230
TOLSONA MTN L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,072	1.230

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
HARDING L	AYK	SHEEFISH	CLEAR H	FINGERLING	KOY-YUKON MIX	109,503	0.990
RUSSELL CR	AKP	SOCKEYE	RUSSELL CR H	FED FRY	MORTENSON CR	320,000	0.240
HARDING L	AYK	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA I	515,000	0.160
GLACIER FLATS	CCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	6,005,000	0.247
MORTENSON CR	KOD	SOCKEYE	RUSSELL CR H	FED FRY	MORTENSON CR	612,000	0.237
KITOI BAY	KOD	SOCKEYE	KITOI H	SMOLT	U STATION L	143,725	2.480
CHENIK L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	3,500,000	0.210
ELUSIVAK L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	500,000	0.190
HAZEL L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	1,000,000	0.190
KERSHNER L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	250,000	0.210
L PAINT L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	500,000	0.190
LEISURE L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	2,000,000	0.190
PORT DICK L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	430,000	0.190
U PAINT L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	1,000,000	0.190
BIG L (BIG L)	NCI	SOCKEYE	BIG LAKE H	FED FRY	MEADOW CR	1,170,000	0.170
MEADOW CR	NCI	SOCKEYE	BIG LAKE H	EMERGENT F	MEADOW CR	1,316,000	0.159
MEADOW CR	NCI	SOCKEYE	BIG LAKE H	FED FRY	MEADOW CR	10,719,848	0.184
SPEEL L	NSE	SOCKEYE	SNETTISHAM H	EMERGENT F	SPEEL L	224,122	0.180
ESTHER PASS L	PWS	SOCKEYE	MAIN BAY H	EMERGENT F	COGHILL L	154,644	0.220
MAIN BAY	PWS	SOCKEYE	MAIN BAY H	SMOLT	COGHILL L	3,924,331	10.351
PASS L	PWS	SOCKEYE	MAIN BAY H	EMERGENT F	COGHILL L	603,219	0.220
CROSSWIND L	PWS	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA I	3,130,373	0.160
GULKANA I	PWS	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA I	10,105,208	0.156
GUNN CR	PWS	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA I	12,004,491	0.160
GULKANA II	PWS	SOCKEYE	GULKANA II H	EMERGENT F	GULKANA II	765,500	0.156
HUGH SMITH L	SSE	SOCKEYE	BEAVER FALLS H	EMERGENT F	HUGH SMITH L	532,800	0.162
KLAWOCK L	SSE	SOCKEYE	KLAWOCK H	EMERGENT F	KLAWOCK R	2,426,132	0.167
KLAWOCK L	SSE	SOCKEYE	KLAWOCK H	FED FRY	KLAWOCK R	44,552	0.510
MCDONALD LAKE	SSE	SOCKEYE	BEAVER FALLS H	EMERGENT F	MCDONALD LAKE	3,482,848	0.194
VIRGINIA LAKE	SSE	SOCKEYE	BEAVER FALLS H	EMERGENT F	MCDONALD LAKE	1,886,900	0.193
CROOKED CR	CCI	STEELHEAD	CROOKED CR H	SMOLT	CROOKED CR	24,595	94.600
SIX MILE CR	NCI	STEELHEAD	CROOKED CR H	SMOLT	CROOKED CR	66,108	66.800
KETCHIKAN CR	SSE	STEELHEAD	DEER MOUNTAIN H	FED FRY	KETCHIKAN CR	16,757	0.590

Appendix 1. Salmonids stocked by FRED Division in 1989

Includes all releases as of 1 December 1989

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
KETCHIKAN CR	SSE	STEELHEAD	DEER MOUNTAIN H	SMOLT	KETCHIKAN CR	2,693	10.000
KLAWOCK L	SSE	STEELHEAD	KLAWOCK H	SMOLT	KLAWOCK R	50,314	22.200
WARD L	SSE	STEELHEAD	KLAWOCK H	SMOLT	KLAWOCK R	38,667	14.933

APPENDIX 2

Life-Stage Survival Summaries for Fish Released in 1989

Appendix 2. FRED Division Life Stage Survival Report , includes stocks released in 1989

			Adjusted green eggs	Eyed eggs	% surv to eyeup	Fry emerged	Fish released	Comments
BEAVER FALLS	SOCKEYE	88 HUGH SMITH L	612,000	548,000	89.5	533,000	533,000	
BEAVER FALLS	SOCKEYE	88 MCDONALD L	6,710,000	5,920,000	88.2	5,590,000	5,370,000	
BIG LAKE	COHO	86 BIG L (BIG L)	3,180,000	2,930,000	92.1	2,810,000	2,720,000	
BIG LAKE	COHO	87 BIG L (BIG L)	3,300,000			3,070,000	2,700,000	2.6M released in 88. 37K FOH
BIG LAKE	COHO	88 L SUSITNA R	3,060,000	2,850,000	93.1	250,000	8,400	
BIG LAKE	SOCKEYE	88 MEADOW CR	19,700,000	18,100,000	91.9	13,200,000	13,200,000	
CLEAR H	ARCTIC CHAR	86 ALEKNAGIK L	20,600	8,250	40.0	8,250	4,150	115 held for brood
CLEAR H	ARCTIC CHAR	87 ALEKNAGIK L	183,000	155,000	84.7	111,000	81,400	
CLEAR H	ARCTIC CHAR	88 ALEKNAGIK L	315,000	212,000	67.3	106,000	71,900	
CLEAR H	COHO	88 WOOD CR	775,000	755,000	97.4	740,000	737,000	
CLEAR H	GRAYLING	86 MOOSE L (GLEN)	1,900,000			1,740,000	1,150,000	
CLEAR H	GRAYLING	89 MOOSE L (GLEN)	2,800,000			1,890,000	1,570,000	
CLEAR H	LAKE TROUT	88 PAXON L	116,000	106,000	91.4	106,000	93,900	
CLEAR H	RAINBOW	88 SWANSON R	243,000	125,000	51.4	123,000	113,000	EEgg xfer from Ft Rich
CLEAR H	RAINBOW	89 SWANSON R	810,000	663,000	81.9	574,000	425,000	EEgg xfer from Ft Rich
CLEAR H	SHEEFISH	88 KOY-YUKON MIX	945,000	318,000	33.7	200,000	110,000	
CROOKED CR H	COHO	87 CROOKED CR	815,000			289,000	70,700	
CROOKED CR H	SOCKEYE	88 GLACIER FLATS	19,400,000	16,000,000	82.5	15,200,000	15,200,000	2.1M EEgg destroyed
CROOKED CR H	STEELHEAD	87 CROOKED CREEK	130,000	127,000	97.7	126,000	90,700	
CRYSTAL LAKE H	CHINOOK	87 CRYSTAL CR	2,620,000	1,480,000	56.5	1,370,000	1,100,000	
CRYSTAL LAKE H	CHINOOK	88 CRYSTAL CR	2,570,000	1,990,000	77.4	1,510,000		1.4M FOH
CRYSTAL LAKE H	COHO	87 CRYSTAL CR	933,000	788,000	84.5	776,000	757,000	649K released prior
CRYSTAL LAKE H	COHO	88 CRYSTAL CR	1,100,000	952,000	86.5	925,000	800,000	
CRYSTAL LAKE H	STEELHEAD	88 CRYSTAL CR	62,000	24,500	39.5	19,000		131.4K FOH
CRYSTAL LAKE H	STEELHEAD	89 CRYSTAL CR	43,500	40,600	93.3	3,300		2.4K FOH

** All numbers are rounded to three significant digits.

Appendix 2. FRED Division Life Stage Survival Report , includes stocks released in 1989

			Adjusted green eggs	Eyed eggs	% surv to eyeup	Fry emerged	Fish released	Comments
DEER MOUNTAIN H	CHINOOK	87 KETCHIKAN CR	322,000	221,000	68.6	169,000	176,000	
DEER MOUNTAIN H	CHINOOK	87 KETCHIKAN CR-TR	28,000	22,800	81.4	17,600	15,000	
DEER MOUNTAIN H	CHINOOK	88 L PORT WALTER	366,000	198,000	54.1	191,000		178K FOH
DEER MOUNTAIN H	COHO	87 REFLECTION L	263,000	261,000	99.2	259,000	236,000	108K released prior
DEER MOUNTAIN H	COHO	88 REFLECTION L	291,000	255,000	87.6	255,000	85,000	140K FOH
DEER MOUNTAIN H	STEELHEAD	89 KETCHIKAN CR	35,600	34,500	96.9	26,200	19,500	
ELMENDORF H	CHINOOK	88 CROOKED CR	1,430,000	1,320,000	92.3	1,290,000	1,250,000	Pre-release data is estimate
ELMENDORF H	CHINOOK	88 SHIP CR	134,000	94,200	70.3	91,000	90,000	
ELMENDORF H	COHO	87 BEAR L	284,000	273,000	96.1	285,000	279,000	Pre-release data is estimate
ELMENDORF H	COHO	88 BEAR L	496,000	437,000	88.1	420,000	237,000	180K FOH
ELMENDORF H	COHO	87 SHIP CR	74,000	70,000	94.6	68,400	56,800	
ELMENDORF H	COHO	88 SHIP CR	87,000	84,700	97.4	83,100	15,000	66K FOH
FT RICHARDSON H	CHINOOK	88 NINILCHIK R	245,000	210,000	85.7		200,000	
FT RICHARDSON H	CHINOOK	88 WILLOW CR	761,000	697,000	91.6	682,000	680,000	
FT RICHARDSON H	COHO	87 CASWELL CR	206,000	205,000	99.5	205,000	171,000	9K released prior
FT RICHARDSON H	COHO	88 CASWELL CR	347,000	337,000	97.1	330,000	169,000	149K FOH
FT RICHARDSON H	COHO	87 FLEMING SPIT	188,000	169,000	89.9	161,000	152,000	
FT RICHARDSON H	COHO	88 FLEMMING SPIT	323,000	258,000	79.9	256,000	81,700	168K FOH
FT RICHARDSON H	COHO	87 L SUSITNA R	538,000	527,000	98.0	526,000	359,000	
FT RICHARDSON H	COHO	88 L SUSITNA R	705,000	676,000	95.9	665,000	333,000	307K FOH
FT RICHARDSON H	RAINBOW	89 BIG L (BIG L)	955,000	757,000	79.3	755,000	539,000	5K FOH
FT RICHARDSON H	RAINBOW	86 SWANSON R	93,200	71,000	76.2	70,400	456	Remainder held for brdstk
FT RICHARDSON H	RAINBOW	88 SWANSON R	3,780,000	3,100,000	82.0	3,050,000	3,000,000	2.7M released prior
FT RICHARDSON H	RAINBOW	89 SWANSON R	4,700,000	3,910,000	83.2	2,910,000	2,670,000	367K held for brdstk
GULKANA	CHINOOK	88 GULKANA R	22,100			16,000	16,000	not enumer as EEgg
GULKANA	SOCKEYE	88 GULKANA R	36,200,000			26,500,000	26,500,000	not enumer as EEgg

** All numbers are rounded to three significant digits.

Appendix 2. FRED Division Life Stage Survival Report , includes stocks released in 1989

			Adjusted green eggs	Eyed eggs	% surv to eyeup	Fry emerged	Fish released	Comments
KITOI H	CHUM	88 BIG KITOI CR	4,500,000	3,570,000	79.3	3,360,000	3,290,000	
KITOI H	COHO	88 L KITOI L	1,230,000	1,193,000	97.0	906,000	530,000	
KITOI H	PINK	88 BIG KITOI CR	90,758,000	82,824,000	91.3	82,120,000	80,500,000	
KITOI H	SOCKEYE	88 U STATION L	227,000	158,000	69.6	150,000	144,000	
KLAWECK	COHO	88 CABLE CR	59,000	53,000	89.8	53,000	47,000	
KLAWECK	COHO	87 KLAWECK R	1,900,000	1,700,000	89.5	1,660,000	1,400,000	241.7K released prior
KLAWECK	COHO	88 KLAWECK R	2,040,000	1,720,000	84.3	1,670,000	1,340,000	1.1M FOH
KLAWECK	COHO	88 RIO ROBERTS	22,000	18,500	84.1	18,000	12,000	
KLAWECK	SOCKEYE	88 KLAWECK R	3,590,000	2,830,000	78.8	2,310,000	2,470,000	
KLAWECK	STEELHEAD	88 KLAWECK R	105,000	97,000	92.4	93,000	89,000	
MAIN BAY H	SOCKEYE	87 COGHILL L	10,500,000	7,090,000	67.5	5,350,000	5,330,000	1.4M released prior
MAIN BAY H	SOCKEYE	88 COGHILL L	7,150,000	6,460,000	90.3	3,760,000	758,000	2.7M release in 1990
PILLAR CREEK	SOCKEYE	88 AFOGNAK L	1,080,000	504,000	46.7			
RUSSELL CR H	COHO	87 MORTENSON CR	508,000	432,000	85.0	410,000	359,000	
RUSSELL CR H	PINK	88 RUSSELL CR	2,000,000	2,000,000	100.0	1,900,000	19,000,000	
RUSSELL CR H	SOCKEYE	88 MORTENSON CR	1,600,000	1,110,000	69.4	932,000	932,000	
SIKUSUILAQ H	CHUM	88 NOATAK R	6,640,000	6,270,000	94.4	6,120,000	6,050,000	
SNETTISHAM	CHINOOK	87 CRYSTAL CR	2,760,000	1,960,000	71.0	1,500,000	744,000	269K released prior
SNETTISHAM	CHINOOK	88 CRYSTAL CR	3,220,000	2,850,000	88.5	2,610,000		1.7M FOH
SNETTISHAM	CHINOOK	87 KING SALMON R	111,000	104,000	93.7	102,000	72,000	
SNETTISHAM	CHINOOK	88 SNET/KING SAL	54,000	41,000	75.9	40,000		22.9K FOH
SNETTISHAM	CHINOOK	87 SNETTISHAM	1,440,000	1,340,000	93.1	1,290,000	677,000	
SNETTISHAM	CHINOOK	88 SNETTISHAM	1,440,000	868,000	60.3	814,000		525.2K FOH
SNETTISHAM	CHUM	88 SNETTISHAM	8,010,000	7,710,000	96.3	6,830,000	6,400,000	

** All numbers are rounded to three significant digits.

Appendix 2. FRED Division Life Stage Survival Report , includes stocks released in 1989

			Adjusted green eggs	Eyed eggs	% surv to eyeup	Fry emerged	Fish released	Comments
SNETTISHAM	COHO	87 PAVLOF R	48,000	47,000	97.9	47,000		29K FOH
SNETTISHAM	COHO	85 SNETTISHAM	45,000	17,600	39.1	11,000	9,390	
SNETTISHAM	COHO	86 SNETTISHAM	1,600,000	1,550,000	96.9	1,480,000	631,000	436K released prior
SNETTISHAM	COHO	87 SNETTISHAM	134,000	114,000	85.1	103,000		43K FOH
SNETTISHAM	STEELHEAD	86 PETERSON CR	32,000	23,000	71.9	20,600		3K FOH
SNETTISHAM	STEELHEAD	87 PETERSON CR	11,700	11,500	98.3	7,800		3K FOH
SNETTISHAM CIF	SOCKEYE	88 SPEEL L	295,000	251,000	85.1	235,000		
TUTKA BAY H	CHUM	88 TUTKA BAY	2,590,000	2,390,000	92.3	2,170,000	2,160,000	
TUTKA BAY H	PINK	88 TUTKA BAY	46,000,000	40,500,000	88.0	37,200,000	37,000,000	

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